

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRIC ATTRACTING

- On-the-job close-up of pole-line and substation work by B. B. Electrical Contractors, Inc. at 6000-acre Picatinny Arsenal. **page 65**

- Machine rebuilding for higher output, longer life; an analysis of markets and techniques from the experience of the Marine Electric Corp. **page 71**

- How preventive maintenance covering thousands of motors and controls is handled in a Philadelphia newspaper plant. **page 78**



A MCGRAW-HILL
PUBLICATION

56

TH YEAR



He's reaching for...
the **BEST**
ELECTRICAL
TAPE...



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FRICITION, RUBBER SPLICING,
and PLASTIC TAPES

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 ADEQUATE WIRING HOME, NEW ORLEANS, LA.: SPECIFIED REMCON

Are you getting your share?

TODAY MORE AND MORE HOMES SPECIFY REMCON

More and more of the nation's trend-setting builders are putting REMCON into their model homes. Never before has such a major advance in electrical wiring been adopted by so many so fast.

REMCON
low voltage switching

A division of Pyramid Instrument Corporation, Lynbrook, N. Y.
 manufacturer of the famous AMPROBE snap-around volt-ammeter.

More and more electricians ask for REMCON! They've found it satisfies their customers and boosts profits as much as 40%. That's why they come back for more. Start cashing in with REMCON NOW.

4 EXCLUSIVE

REASONS WHY...

- **"FLAME-TIGHT" CONTACT CHAMBER**
Exclusive safety chamber prevents explosions even when fixture is serviced with current on! APPLETON Series AA-51 Vented Explosion-proof Fixtures offer the positive protection required for hazardous areas.
- **"FULL-CIRCLE" VENTING**
Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.
- **"INTERCHANGEABLE" UNILET BODY**
Standardized diameters at top of Dome Unit Assembly permit interchange with AA-51 fixtures of varying wattages.

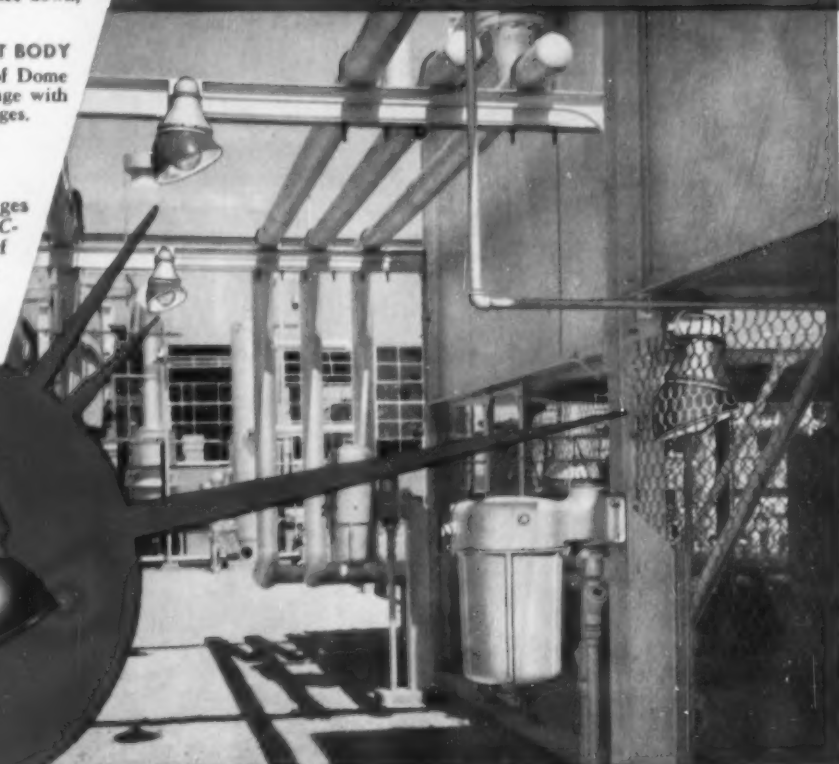
plus

conversion to different wattages or relamping in just 58 SECONDS! . . . with no loss of man-hours or lengthy shut-downs. Send for complete information today!



APPLETON

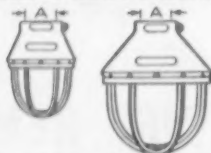
vented Explosion-Proof Fixtures are BETTER!



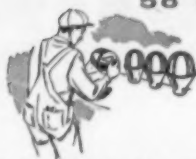
58 SECOND RELAMPING

Photo Courtesy
Oil and Gas Journal

APPLETON INTERCHANGEABLE UNILET BODY FEATURE



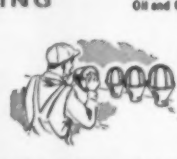
Note how identical diameters "A" on Dome Assemblies allow quick interchange of fixtures with different wattages.



Series AA-51 stand-by units are ready at an instant's notice for relamping . . . with handles attached in advance



Only a screw driver is needed to change units . . . and ONLY 58 SECONDS to climb ladder, change unit and descend!



Cleaning fixtures, changing burned out lamps can safely be attended to at bench . . . preventing costly shut-downs.

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1704 Wellington Avenue, Chicago 13, Illinois

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Lights



Automatic
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Malleable Iron
Unilet Fittings



"ST" Series
Connectors



Outlet Boxes

Rely on APPLETON . . . the standard for better wiring

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The
Electrician and Electrical Record . . . Established 1901

Published for electrical contractors, industrial electricians,
engineers, consultants, inspectors and motor shops. Covering
engineering, installation, repair, maintenance and manage-
ment, in the field of electrical construction and maintenance.

56th Year **DECEMBER • 1956**

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Sidelights

OUTSIDE CONSTRUCTION—

Throughout the country, little recognition or publicity is given to the work performed by electrical pole-line contractors. Operating away from city areas—generally in sparsely settled suburbs, across vast open stretches of farmland or forests or in uninhabited mountainous terrain—these contractors are seldom seen by the public. Yet they are constructing the transmission and distribution lines and substations to bring life-blood electric power to every city, town and village. The public that never sees them could not get along without them. Because design and installation of outdoor electrical systems is so important—volume of outside work is increasing and high voltage technology is developing—we are going to give you more information on outside electrical construction performed by electrical contractors. Typical of the type of story you can be looking for is "Pole-Line Distribution", page 65. This story covers an extensive job of "furnish and install all equipment and devices" for power generating and distribution facilities at Picatinny Arsenal, Dover, N. J., the nation's leading ammunition research and development center.

BUS SERVICE—Distribution of electric service to the various occupants

of a large shopping center in Gary, Ind. is provided by six concealed bus duct circuits, each serving four to six stores. The novel installation was made by Sweney Electric Company of Gary to combine economy with convenient flexibility for changes. The system is described by Robert E. Walton in "Concealed Bus Duct Service Entrance" beginning on page 74.

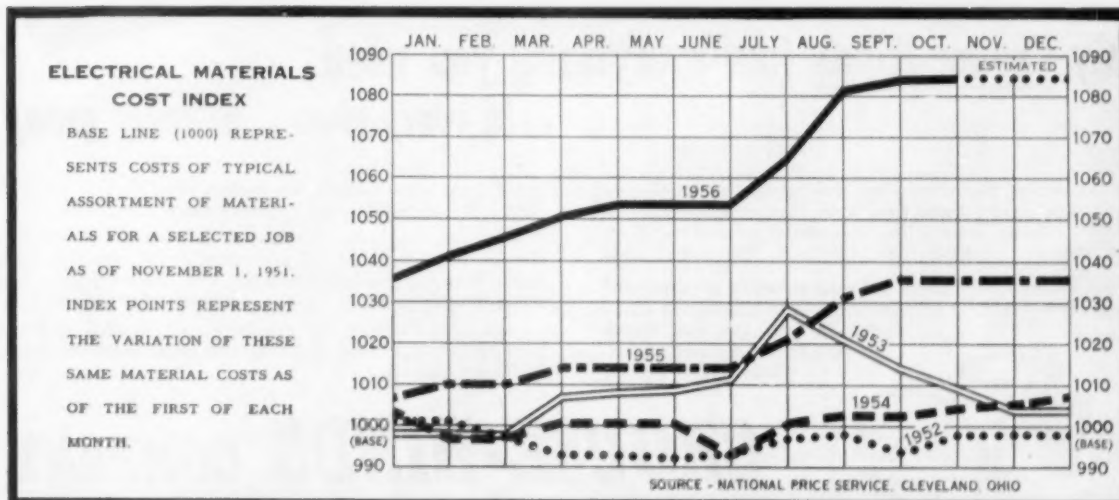
ONE OF THE NATION'S LARGEST

and most diversified newspaper-magazine publishing houses is that of the Philadelphia Inquirer, where total weekly edition figures run close to the 100-million mark. Contained in two adjacent and connected buildings—one sparkling new, the other several decades old—a wide range of electrical equipment ranges from exposed knife-switch boards and 30-year-old magnetic press-drive controls to modern drawout-breaker switchgear and fully-automatic electronic and ignitron rectifier assemblies. This diversity of equipment, plus the necessity for infallible round-the-clock operation, demands that maintenance be preventive in its fullest meaning. Electrical contractor John F. McCarthy supplies this vital service—which is comprehensively discussed in the article "Electrical Maintenance in a Newspaper Plant" which starts on page 78.

SILICONES are not magic cure-alls for all motor ailments. However—where high temperatures, moisture, corrosion, chemical attack, overloads, rapid reversing, high starting loads, fluctuating demands, shock, vibration or dirt are present to cause industrial headaches—it is advantageous to investigate possibilities for using Class H insulation. Under unusual or severe operating conditions this insulation has permitted trouble-free service; resulting in greater production, more power per unit weight and size, longer life, greater operating efficiencies and reduced maintenance. Numerous actual examples that illustrate these advantages are included in the article, "More For Your Silicone Dollar" which appears on page 93.

MOTOR SHOP'S NEW MARKET—

Opportunities for new motor service business have been created by industry's increasing need for additional power output and longer, trouble-free life from its motor and generator equipment. Chief Engineer Harry G. Parke of Marine Electric Corp. in Brooklyn, N. Y. discusses the background of this market and adds technical pointers derived from his recent job powering up 84-400 kw generators. His report, "Rebuilding Rotating Machines" begins on page 71.



Puzzled about getting the Right Explosion-Proof Lighting Equipment?



**Only Crouse-Hinds has everything you need
...in every class ...in every group!**

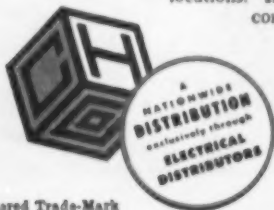
For complete protection when making lighting installations in hazardous locations you need more than explosion-proof or dust-tight lighting fixtures. You also need UL-listed explosion-proof switches, junctions, fixture supports, unions and seals.

Crouse-Hinds now offers a broad selection of Condulet* explosion-proof lighting equipment for Class I, Groups A and B locations. In fact, you can specify complete Crouse-Hinds explosion-proof lighting

installations, all UL-listed, no matter what class or group of Article 500 of the National Electrical Code is involved.

The same holds true for the entire Crouse-Hinds Condulet line of more than 15,000 conventional and explosion-proof items. With the broadest line in the field, Crouse-Hinds recommends exactly what you need . . . and only what you need.

A nearby Crouse-Hinds distributor will be glad to discuss your explosion-proofing problems and make recommendations without obligation.



*Registered Trade-Mark

CROUSE-HINDS COMPANY

Main Office and Factory: Syracuse, N. Y.
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OFFICES: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Corpus Christi, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., St. Louis, St. Paul, San Francisco, Seattle, Tulsa, Washington. RESIDENT REPRESENTATIVES: Albany, Atlanta, Baltimore, Boston, Bridgeport, Charlotte, Chattanooga, Jacksonville, Reading, Pa., Richmond, Va., Shreveport.

Washington Report

1956 closes with business scoring another annual record. Gross national product in 3rd quarter was at \$414-billion annual rate, up from \$396.8-billion annual rate in 3rd quarter of 1955, while 4th quarter production of mines and factories seems certain to set a new record. The year ends on an optimistic note of continuing growing demand, which is easily matched by increasing productive capacity.

The business climate is expected to remain favorable under the reelected Republican Administration. Economic factors generally support continuing prosperity, long range. But the short range outlook is overshadowed by the "cold war" mood created by a stepped-up Soviet threat in the Middle East and in Europe. Important domestic problems, such as taxes, school construction, labor law revision, welfare, mortgage credit, etc., are currently being subordinated to the more crucial issue of world peace. President Eisenhower, however, will spell out his proposed solutions for these problems in his annual message to Congress in January, and call for action as soon as possible.

New construction expenditures in 1957 will increase 5% above this year's record \$44-billion volume, according to outlook estimates prepared by Depts. of Commerce and Labor (watch for details in "1957 Outlook", EC&M, January 1957). Residential construction will decline 3% from the 1956 volume, it is estimated, while private industrial, commercial, hospital, and public construction (highways, schools, sewer and water facilities) will increase.

Outlays for new construction in October were \$4.1 billion, off seasonally from September's \$4.3 billion, but still above the \$4 billion volume of October 1955. Private housing volume declined, while most other major types of construction were at October highs.

Capital expenditures for new plant and equipment were \$9.6 billion in the 3rd quarter, are estimated at \$9.4 billion for the 4th quarter, will set a new annual record of \$35.3 billion. Durable goods manufacturers show the largest gains for the year, with railroads second in gains.

Tight credit policy gets blame for decline in homebuilding, while FRB check on credit over-expansion draws adherents as well as critics, both in and out of the Administration. Housing Chief Albert Cole will ask Congress early next year to ease credit restrictions on homes. But other Administration spokesmen and FRB officials consider the current policy necessary to hold building costs down, help prevent inflation.

Housing starts in October were 93,000, same as in September, but 12% below a year earlier. Estimated starts for 1956 are 1,050,000.

The housing vacancy rate has changed very little during the past year, Census Bureau reports, and was 2.6% for the second quarter of 1956.

Some construction highlights: The Government has approved construction of 31 public buildings, at estimated total cost of \$224,845,000, under the Lease-Purchase Act of 1953 (and will include buildings costing: \$65,100,000—New York City; \$23,960,000—Pittsburgh; \$21,700,000—Cincinnati; \$19,170,000—Baltimore; \$15,200,000—Brooklyn; \$13,760,000—St. Louis; and \$7,600,000—Salt Lake City) . . . General Service Administration has been given \$355 million for federal public buildings in the Washington area over the next three years . . . Electric utility companies have 16 atomic power plants proposed at estimated cost of \$425 million, with capacity of over 1,100,000 kilowatts . . . Bell Telephone System has scheduled a record breaking \$2.3 billion construction program for 1957.

The advertisement at the right is part of the Kennecott-sponsored national advertising campaign for better home wiring. Its purpose, and that of other advertisements in the series, is to make homeowners recognize the importance of full-powered copper wiring to the convenience, comfort and safety of their homes.

Here is an effective "public service" campaign that benefits you. *It leads to more profitable wiring contracts, opens up more rewiring business for you.*

Let this campaign work for you directly, in your own territory, teamed with your own local, adequate wiring promotions. Send today for *free* reprints and poster-sized blowups of Kennecott's latest national advertisements featuring "Skimpy Wiring." Get *free* copies of the educational booklet, "The ABC of Home Wiring." Ask for complimentary Home Wiring Wall Chart, mat service folder and list of at-cost prices for all material available. No cost or obligation! Just write on your letterhead to Kennecott Copper Corporation, Dept. EC126, 161 East 42nd St., New York 17, N. Y.

The best wiring is copper

This ad appears in:
This Week Magazine
Section, Sept. 23, and
Chicago Tribune
Magazine
Section
Oct. 21



He slows down the best of appliances!

Don't blame your toaster for making toast too slowly. "Skimpy Wiring" may be holding it back. His weak, undersized wires and inadequate circuits keep toasters, and other electrical appliances, from getting the full power they need to operate at their best.

Find out how to rid your home of the electrical ills symbolized by "Skimpy Wiring". Learn how easy it can be... how little it can cost... to give your home the full **HOUSEPOWER** of an up-to-date copper wiring system. Talk it over with your local

power company or electrical contractor.

Get **FREE Booklet!** "The ABC. of Home Wiring" explains facts about your electricity, how you can make it serve you better. Write Kennecott Copper Corporation, Dept. T106, Box 238, New York 46, N. Y.



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ADVANCE TRANSFORMER COMPANY has appointed over 600 Service-Stocking Distributors throughout the United States who are participating in this nation-wide program. These authorized distributors carry a complete stock of all popular ADVANCE ballasts to give immediate replacement service for

any make fluorescent lamp ballast whenever replacement is necessary. Simply bring the inoperative ballast to any ADVANCE Service-Stocking Distributor. The ADVANCE cross-reference guide shows at a glance the replacement needed, and in a few moments, you can be back on the job with the correct ballast.



All ADVANCE fluorescent lamp ballasts carry a two-year warranty and are replaced without charge. The ADVANCE label is your assurance of dependable, efficient performance at lowest cost . . . the result of years of research, engineering and development.



The ADVANCE Service-Stocking Distributor Program enables you to give better service and greater customer satisfaction.

The plan works equally well for all ballast users . . . if you are not now utilizing the ADVANCE Service-Stocking Distributors' Program, write today for complete details.

The Heart of the Lighting Industry



ADVANCE



World's Largest, Exclusive
Manufacturer of
Fluorescent Lamp Ballasts



TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

Congratulations!

... to the American Telephone & Telegraph Company upon the completion of the new Transatlantic cable linking Europe and America.

This engineering achievement, the result of cooperative American and British enterprise, signals a new era of greatly improved Transatlantic telephone service.

Simplex Wire & Cable Co., as manufacturer and supplier of the American-made part of the submarine cable used in this gigantic project, is understandably proud to have participated in this historic accomplishment, and in the development work which made it possible. **SIMPLEX WIRE & CABLE CO.**, 79 Sidney Street, Cambridge 39, Mass.

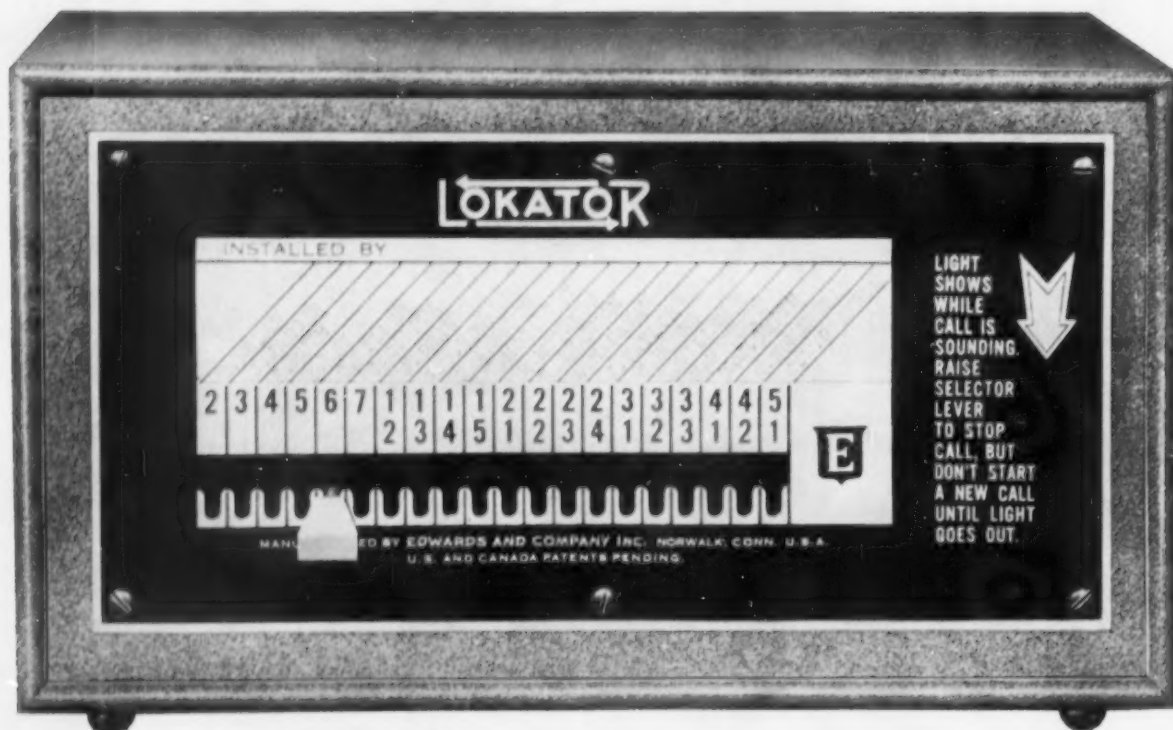
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Wires and Cables for:



PICTURE OF CONTRACTOR PROFITS!

with EDWARDS automatic LOKATOR® Paging System!



specialists in signaling since 1872

EDWARDS

DESIGN / DEVELOPMENT / MANUFACTURE

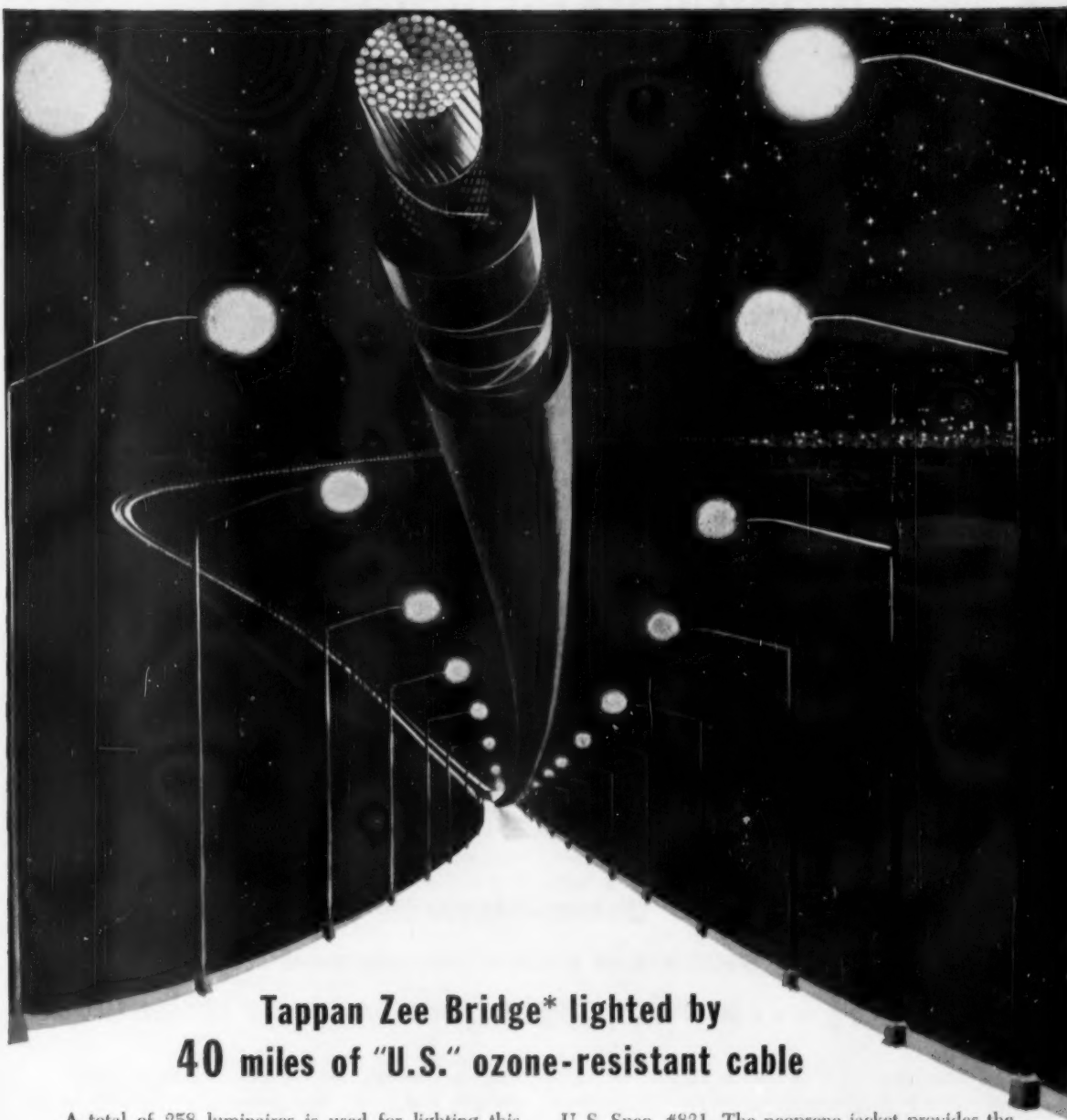
Factories, offices, stores and institutions all like its easy operation and dependability . . . you'll like the fast, simple way you can install it in any location (and no call backs for service)! Edwards' Lokator Paging System is so simple operators need no complicated instructions or call directory, so soundly designed it's virtually maintenance-free.

Capacity of the Lokator is flexible enough to meet all needs, with 20, 40 and 60-call Selector units (higher capacities by combining units). You can use signaling devices already installed to convert an old system to an automatic Lokator system. Paging locations can be increased merely by adding signals. A wide variety of chimes, bells, horns or visual signals is available to meet all requirements.

For more sales and more satisfied customers, specify and install Edwards' Lokator Paging System. For full information, see your Edwards Distributor, your Edwards Technical Specialist, or write: Dept. EC-12, Edwards Company, Inc., Norwalk, Connecticut. (In Canada, Edwards of Canada, Ltd., Owen Sound, Ontario.)



STREET LIGHTING CABLE



Tappan Zee Bridge* lighted by 40 miles of "U.S." ozone-resistant cable

A total of 258 luminaires is used for lighting this bridge spanning the Hudson River, making it probably the best-lighted bridge in the world. To minimize distribution costs, constant current series circuits are used.

The 40 miles of cable used on this lighting system is ozone-resistant "U. S." Series Street Lighting Cable, Uskorona - 2, butyl insulation, 7,500-volt shielded,

U. S. Spec. #831. The neoprene jacket provides the greatest protection against weather, acids, oils and all-around abuse. Yet the cable is light in weight and easy to handle.

For electrical wires and cables to fill any requirement, to handle any wiring need, write Electrical Wire & Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

*Part of New York State Thruway system



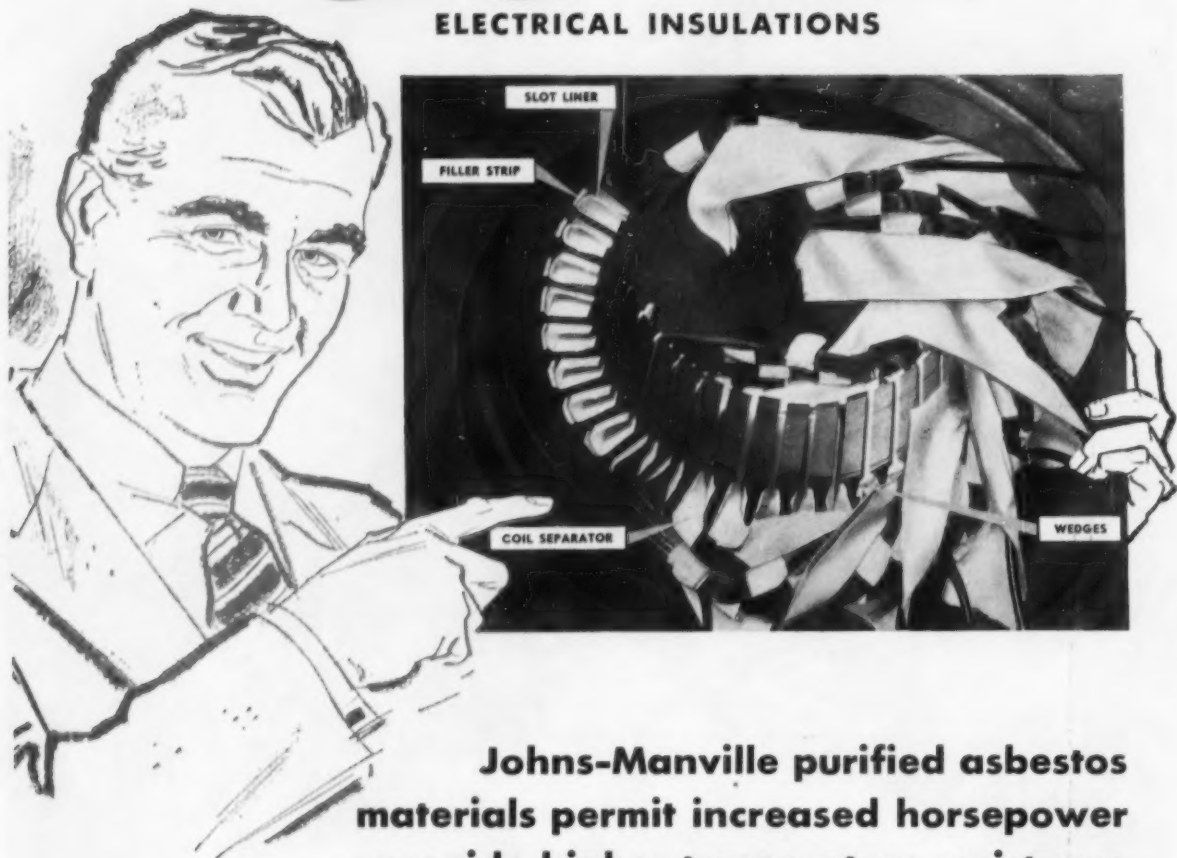
Electrical Wire & Cable Department

United States Rubber

Smaller motors carry bigger loads
when you insulate with

Quinterra®

ELECTRICAL INSULATIONS



**Johns-Manville purified asbestos
materials permit increased horsepower
... provide higher temperature resistance**

MOTORS insulated with Quinterra will outperform others of substantially higher rating but with less heat-resistant insulation.

The above photograph shows how you can use Quinterra and its companion product Quinterrabond® on a standard Class H induction motor. Quinterra Type 3-GR was employed for slot liners and coil separators. Wedges and filler strips are of Quinterrabond Type 3. Both materials are made from highly purified asbestos fibres treated with silicone

resin for the highest combination of dielectric strength and pyrolysis resistance obtainable. In addition, Type 3-GR is reinforced with a strengthening layer of fine glass cloth.

Johns-Manville has developed a complete line of Quinterra materials for application in motors, transformers and other electrical apparatus. For further information write for brochure EL-40A. Address Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.



Johns-Manville ELECTRICAL INSULATIONS

KILLARK ELECTROLETS are stronger than ever!



THE ALUMINUM IS STRONGER!

Modern metallurgy has produced an aluminum alloy for today's Killark Electrolet that is more malleable, more resistant to installation shocks and strains than ever before in the history of conduit fittings.

THE DESIGN IS MORE RUGGED!

Killark engineering has produced a fitting designed for maximum strength at all the points of stress... designed for the extra demands of today's installations.

THE METHOD OF MANUFACTURE IS BETTER!

Ten thousand pounds better! That's how much pressure goes into the die-casting of today's Killark Electrolet—to give you a fitting that's closer-grained, tougher, more resistant to rust or corrosion than ever before.

...A FITTING NAME TO REMEMBER



Killark

ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves.

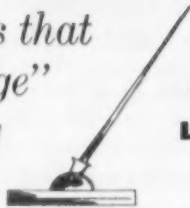
St. Louis 13, Missouri

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Sales Offices and Warehouse Stocks throughout Canada



*Another Bank gets that
"Look of Prestige"
Economically*



**with Lighting by
LITECONTROL**

Quiet elegance . . . maximum lighting efficiency at desk level — this installation of the Philadelphia National Bank, Lansdale, Pennsylvania, has *both*.

Time was when this type of impressive lighting represented a considerable investment. But no more! *Standard* Litecontrol fixtures held costs down here as they have elsewhere in many other bank, school, office and store installations.

Litecontrol series 3500RS rapid start

troffers were used with Holophane low brightness lenses in hinged doors with Trigger Catches. Note how well the orderly but interesting rectangular fixture arrangement blends with the clean lines of the counters and furnishings.

"Litecontrol" is a good name to remember whether you specify, design or install lighting equipment — and quality, cost and upkeep *all* have to be right!

INSTALLATION:
Philadelphia National Bank, Lansdale Office,
Lansdale, Penna.

DESIGNED BY:
The Cummen Company, Philadelphia, Penna.

ELECTRICAL CONTRACTOR:
Swartley Brothers, Lansdale, Penna.

FIXTURES:
Litecontrol #3524RS and 3548RS (lamps in
tandem) with Holophane #9016 lenses

INTENSITY:
55 Footcandles in Service



LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALE



Now!

SAVE UP TO 25% with aluminum feeder bus duct

Bus duct distribution systems engineered with Reynolds Aluminum Bus Conductor are now even more economical because of the 25% price differential between aluminum and copper feeder bus duct. And that's only one of the reasons more and more commercial buildings, hotels and large stores are installing this modern method of distributing electrical energy.

Aluminum bus duct distribution systems are also extremely flexible. They're adaptable to horizontal or vertical layouts in small buildings or large. Prefabricated bus duct sections can be extended swiftly in the expansion of electrical systems . . . for lighting improvements . . . air conditioning installations . . . and other electrical modernization. Outlets are always easily accessible. In addition bus duct sections are practically 100% salvageable . . . can be removed from existing installations and used elsewhere without appreciable loss of material.

CONTRACTORS: Quote aluminum when you figure bus duct distribution systems. Time and labor savings in installation will permit lower, more competitive bids.

Reynolds Aluminum Bus Conductor

Reynolds pioneered the development of extruded bus conductors now used by all the major bus duct manufacturers. These aluminum conductors are

available with a variety of properties and in an unlimited range of sizes and shapes.

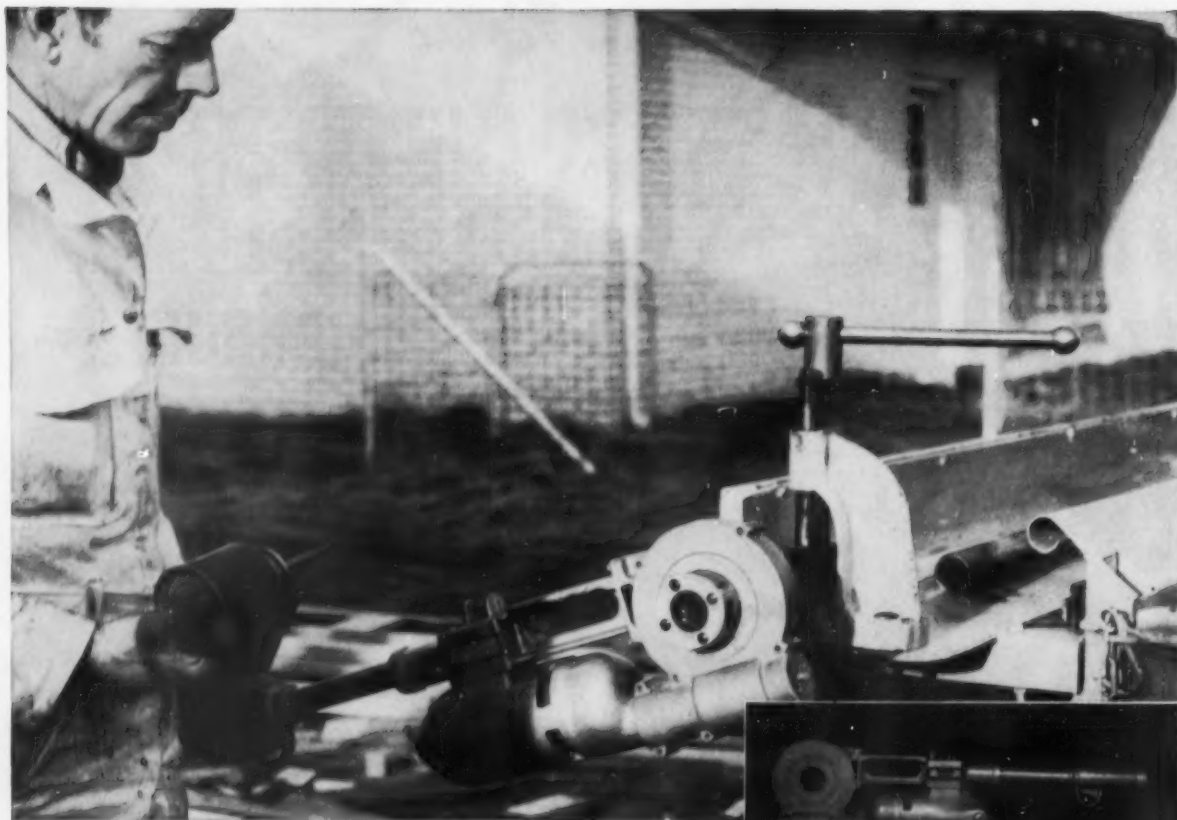
Reynolds does not make bus duct distribution systems, but for more information about their advantages and for names of system manufacturers write Reynolds Metals Company, P.O. Box 1800-ET, Louisville 1, Ky.

**The Finest Products
Made with Aluminum**

are made with

REYNOLDS  ALUMINUM

See Reynolds New Program,
"CIRCUS BOY", Sundays on NBC-TV



Threads Conduit in seconds ...the Lawco, Jr.

PORTABLE PIPE THREADER

Here's the answer to those slow, tiring, hand-threading jobs. The Lawco, Jr. Portable Pipe Threader does the work in seconds. This modern portable power tool threads the smallest to the largest conduit. Simple adapters and speed reducers handle pipe from 1/4-inch to 10".

Its operation is simple. Just position Lawco, Jr. on the conduit, press the trigger, and the power unit drives the cutting dies. You're finished in no time, and right at the location where you are installing the conduit.

And Lawco, Jr. comes in handy for other jobs, too. Several are illustrated at the right. In addition to these applications, you can use your Lawco, Jr. for driving nuts and bolts, and hoisting weights up to 500 pounds.

This light weight (20 lbs.) tool is precision built for years of service. Write for details.

VELOCITY POWER TOOL CO.

201 North Braddock Avenue, Pittsburgh 8, Pa.



The Lawco, Jr.—portable, versatile, compact. Does a variety of jobs faster, better.



Augering operation with Lawco, Jr. Efficient in vertical or horizontal operations.



Post hole application using square shank. Lawco, Jr. does it faster.



There's nothing better for pulling wire through conduit than the Lawco, Jr. The unit's portable feature speeds work.

How S&C "JOB MATCHED"

Metalclad Switchgear

saved 50%

for Twin Disc Clutch

Typical high-voltage power supply systems for industrial plants are rarely exposed to faults, either transient or permanent. For that reason they can use the simple radial form of power distribution, and dispense with high-priced protective equipment that provides automatic reclosure against faults. Reliable interruption of permanent faults and occasional switching is all that is required; and this is provided by S&C Metalclad Switchgear.

The plans for doubling the high-voltage power system capacity at Twin Disc Clutch Company included S&C Metalclad Switchgear for the high-voltage switching center... the 3-unit assembly is shown. In addition to the substantial economies resulting from elimination of complex equipment, S&C gear saved valuable ground space normally required for an open structure.

Experienced S&C engineers will be glad to assist you in building economy into your high-voltage power supply.

*Specialists in High-Voltage Switchgear for
Electric Utilities since 1910*

S&C ELECTRIC COMPANY

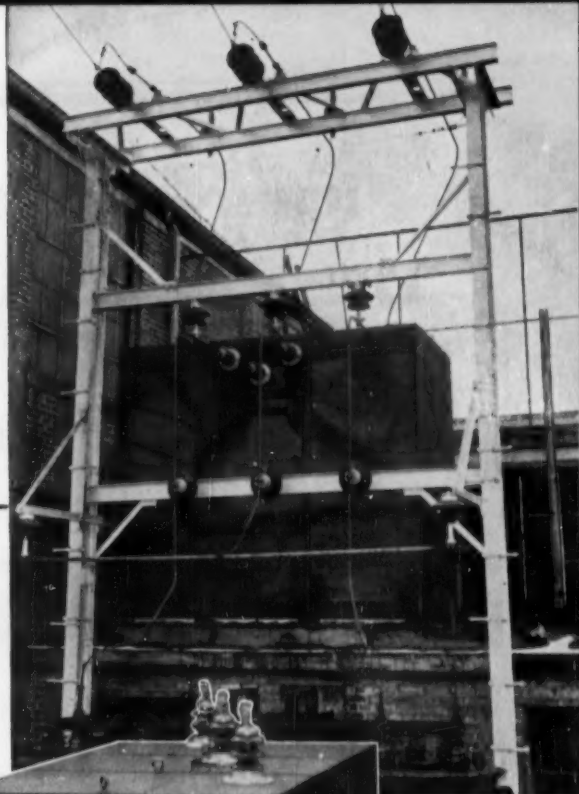
4433 RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS, U. S. A.

In Canada:

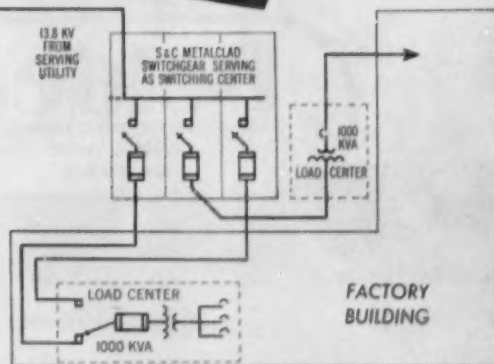
S&C Electric Canada, Ltd., 8 Vansco Rd.
Toronto 14, Ontario



Diagram at right shows use of S&C
Metalclad Switchgear in radial-
type circuit at Twin Disc
Clutch Company



Exum
French,
President,
B. & F. Hi
Line Construc-
tion Corp., Rock-
ford, supervised
the installation.

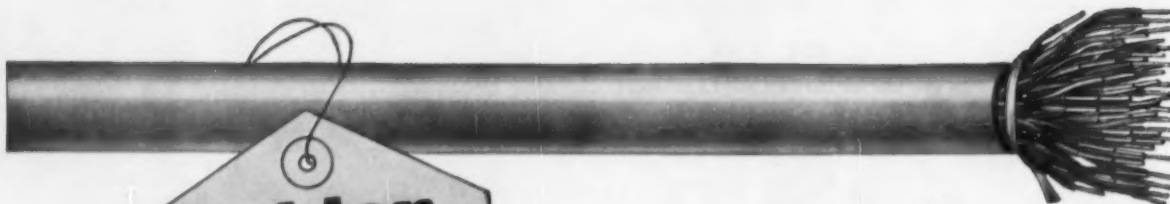




If it's worth Engineers' time . . .



. . . It's worth Engineered Cable



Belden

**INTERCOMMUNICATING
AND
SOUND SYSTEM CABLES**

Indoor-outdoor, phones
or speakers—there is a
Belden engineered cable
to meet your needs for
a permanent, trouble-
free installation.

"Items from the
Complete Belden Line"

*Intercommunications systems in
the Statler Hilton in Dallas,
and other leading hotels
with intercommunications
systems, are wired by Belden.*



Belden

**WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO**

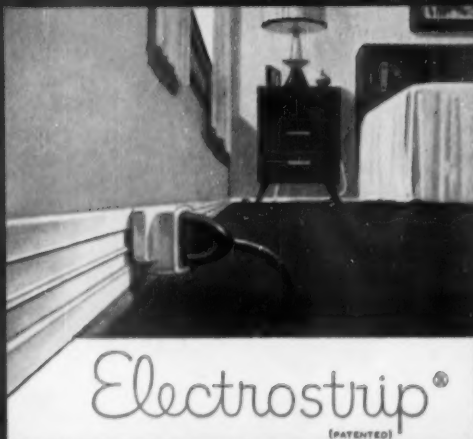
10-9

Magnet Wire • Lead and Fixture Wire • Power Supply Cords, Cord Sets and Portable Cord • Aircraft Wires
Welding Cable • Electrical Household Cords • Electronic Wires • Automotive Wire and Cable

NOW... here's real
HOUSEPOWER

**TWIST IN
ELECTRIC
OUTLETS...**

**exactly where
you want them!**



Electrostrip®
(PATENTED)

Not enough outlets to plug in your lamps, radios, clocks, TV, kitchen appliances? Try new Electrostrip—and enjoy real electrical freedom! It's every inch an outlet... neat, safe... gives you all the outlets you need right where you need them. Lets you arrange furniture as you like it... eliminates the hazards of overloaded wall sockets and long, unsightly extension cords, too.

Call Western Union by number and ask for Operator 25 for the name of your nearest Electrostrip contractor. Or Write Bulldog Electric Products Co., Detroit 32, Mich.

©BEPKO



... and real opportunity
for you to profit
with *Electrostrip*

Bulldog ties in with EEI and the million-dollar "HOUSEPOWER" campaign. Colorful, hard-selling ads like this currently run in such outstanding consumer books as *Better Homes and Gardens*, *Good Housekeeping*, *Home Modernizing* and *Small Homes Guide*. They pre-sell prospective customers on Electrostrip... make your selling job easier.

Powerful advertising in leading trade publications sells builders, hotel, institutional and other building management groups on Electrostrip's advantages, too.

And Bulldog goes a step further. For your support and protection, Electrostrip is sold *only* to qualified electrical contractors and *only* through qualified Bulldog distributors. It's listed by U.L.

So tie up with Electrostrip for real profits and bigger sales. See your distributor or Bulldog field engineer. Or write Bulldog Electric Products Co., Detroit 32, Mich.

© BEPCO

ARE YOU LISTED?

Through Western Union, Operator 25 service, Bulldog directs customers *right to you*. Be sure you're listed. Contact us for details.

BULLDOG



ELECTRIC PRODUCTS COMPANY
A Division of I-T-E Circuit Breaker Company

Export Division: 13 E. 40th St., New York 16, N. Y.

In Canada: Bulldog Electric Products Co., Ltd., 80 Clayson Rd., Toronto 15, Ont.

Beautiful, New, Luminous, Indirect Store Lighting Can Be Low Cost, Too!



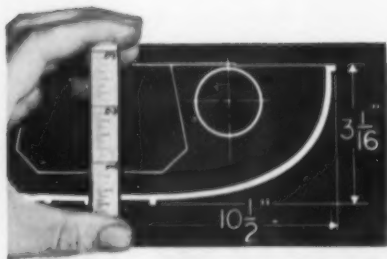
the New **CAPRI**
introduces a new beauty concept
in low silhouette—low brightness—low budget lighting!

The slimmer, trimmer lines of the new CAPRI improves appearance, enhances selling areas and attracts more customers. With CAPRI you get the full benefit of the finer quality of light delivered by luminous indirect lighting design. Note especially its petite, inconspicuous silhouette, just $3\frac{1}{16}$ " high and $10\frac{1}{2}$ " wide! Its a clue to the way CAPRI units blend in beautifully with any architectural scheme. And even with this tiny shape, the CAPRI gives you important brightness control. This means greater seeing comfort for customers and sales clerks alike. It means an atmosphere

that's alive with a sales stimulating quality of light... light for a buying mood.

With all its beauty, the CAPRI is practical, too! Cleaning time is cut way down, because a unique air circulating vent at the bottom of the unit keeps dirt accumulation to a minimum. Sliding hangers help circumvent pipes and duct work. And, best of all, the price is so low that the CAPRI comes well within the most modest store lighting budget.

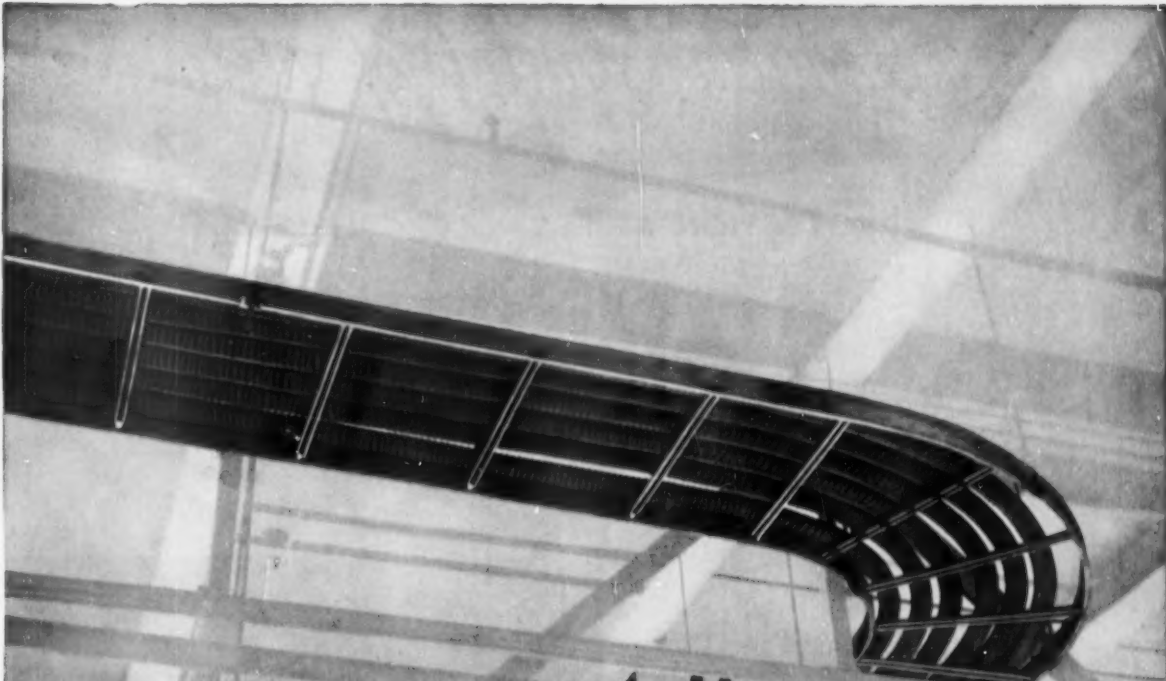
Benjamin Electric Mfg. Co., Des Plaines, Illinois.



low silhouette!
low brightness!
low budget!

BENJAMIN CAPRI

Sold Exclusively through Electrical Distributors



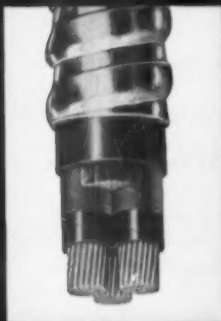
Installation Mahwah Assembly Plant,
Ford Division, Ford Motor Company

GENERAL CABLE

INTERLOCKING ARMORED CABLE SAFE · DEPENDABLE · ECONOMICAL

Modern engineering design and superior flexibility impart extra long life to GENERAL CABLE'S INTERLOCKING ARMORED CABLE. Available in ALUMINUM, BRONZE and STEEL TAPE ARMOR, with every type of insulation for all power applications. Lighter weight and easier to install.

GENERAL CABLE CORPORATION,
420 Lexington Avenue, New York
17, N. Y. Offices and Distribution
Centers Coast-to-Coast.



BE SPECIFIC... SPECIFY GENERAL CABLE



Familiar symbols of safety

PROTECTION AT SEA

LIFE BUOY

FOR YOUR WIRING PROTECTION

Standard-threaded rigid steel conduit is the **only** wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

Water, moisture, vapor, dust and dirt must be kept out of your wiring systems if they are to be permanently safe. To assure reliable and positive protection, specify Youngstown Buckeye full-weight rigid steel conduit. It's the accepted standard of architects, contractors and owners who have found its higher quality and long service life provide increased profits and trouble-free performance. It's easy to bend—easy to fish wires through. Its excellent corrosion-resistance guarantees permanent installations. Call your electrical distributor today—his stocks are ample and ready for delivery to your job site.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Incoloy Steel

General Offices - Youngstown 1, Ohio

District Sales Offices in Principal Cities



Ask your distributor for
Youngstown Buckeye Full
Weight Rigid Steel Conduit
and
Youngstown Electrical
Metallic Tubing.



Behind these old walls lie

Big profits for you!

There are over thirty-four million older homes in America with wiring that can't begin to match the homeowner's appetite for labor-saving appliances.

But positive action is called for on your part to make the average home owner fully aware of the need for adequate wiring, and thus tap this large and growing market.

Modern insulating materials make it easier to sell to both new and old homes alike. Wire and cable insulated with **BAKELITE** Brand Vinyl Plastic give you an effective talking point with prospects—years of added service life. This insulation retains its physical and electrical properties

longer than ordinary types because it's so resistant to cracking, stiffening, and oxidizing.

In addition, this thinner-walled insulation strips and splices easily and cleanly because individual conductors have no fabric or saturating compounds. The job goes faster. **BAKELITE** Vinyl Plastic is listed by UL for 60 deg. C. (140 deg. F.) building wire and for non-metallic-sheathed cable—including the new all-plastic types UF and NMC. Ask your present supplier about the many advantages of this modern wire and cable insulation. He'll give you plenty of reasons for using it in home modernization as well as new home construction.



Remember—everyone benefits from ADEQUATE WIRING insulated with **BAKELITE** Brand Vinyl Plastic

BAKELITE COMPANY, A Division of Union Carbide and Carbon Corporation **UCC** 30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term **BAKELITE** and the Trefoil Symbol are registered trade-marks of UCC.

Jefferson Ballast for 800 MA High Output Fluorescent Lamps



COMPLETE BALLAST SELECTION DATA

New Technical Bulletin B560-10 gives complete selection data on the entire Jefferson Ballast line in compact, easy-to-use form. Write for your copy today!



This Jefferson Ballast is designed to give you Full-Rated light output as specified by the lamp manufacturer.

Only Jefferson has succeeded in *designing and manufacturing* a ballast for two HO 96T12/RS or two HO 72T12/RS lamps capable of giving *full light* output.

Applications include medium and high bay industrial and commercial locations where high output is required.

It is recommended that surface mounted fixtures be checked for conformance to UL temperature requirements.

Remember—for full light output from the new High Output lamps, insist on Jefferson Ballast No. 254-721!

PRIMARY 118 VOLTS*—60 CYCLES—HIGH POWER FACTOR

Catalog No.	Watts	Lamps	MA	Approx. Watt Loss	Sound Group	Minimum Operating Temperature	Net Weight
254-721	(2)100/105	(2)96T12/RS	800	38	F	+50°F	13 Lbs.
	(2)85	(2)72T12/RS	800			-20°F	

Length 14 5/16", Width 3 1/8", Height 2 3/8", Mtg. Centers 13 3/4".

*For 277 Volt lines, specify Catalog No. 254-728.



Jefferson Electric Company

BELLWOOD, ILLINOIS

FOR BURIED CABLE

Jacketing of **ALATHON**[®] provides superior protection plus ease of installation



• Jacketing of ALATHON polyethylene resin provides maximum protection for buried cable. Cables carrying voltages of 15 KV have been buried without conduit—ALATHON assuring outstanding resistance to moisture, chemical action and corrosion.

Because of its moisture resistance, the electrical properties of ALATHON when used as a primary insulator are not affected by wet conditions. This impermeability to moisture is well illustrated in its use as insulation for submarine cable.

Cable protected with ALATHON is light and easy to handle. Installation is speeded by its ease of pulling, cleanness in handling and simplified jointing and terminating requirements. Insulation and jacketing of ALATHON is tough and strong—has excellent abrasion resistance.

To assure economical, trouble-free protection for your wire and cable installations, investigate insulation and jacketing of ALATHON polyethylene resin. For property and application data on ALATHON, clip and mail coupon below.



Jacketing of ALATHON[®] —
for greater durability —
for abrasion resistance

Shield

Insulation of
ALATHON[®] for
heat resistance
and higher
dielectric
strength

There is a difference in polyethylenes—
specify **ALATHON**[®]
polyethylene resin



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department,
Room 4412, Du Pont Building, Wilmington 98, Delaware

Please send me complete information on Du Pont "ALATHON" polyethylene resins. I am interested in evaluating these materials for

Name _____ Position _____

Firm Name _____

Street Address _____

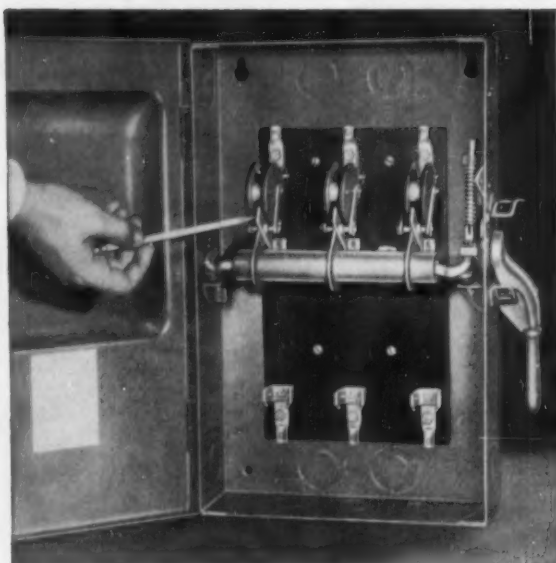
City _____ State _____

Type of Business _____

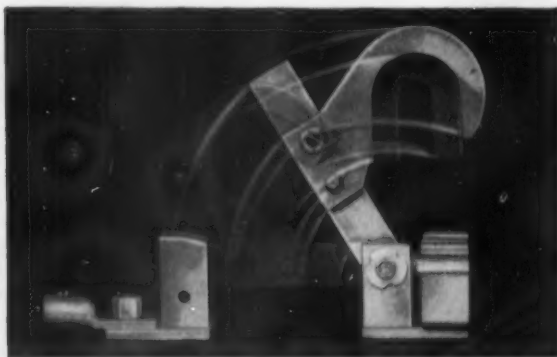
This G-E checklist will help you get heavy duty safety switches that last up to 30 years



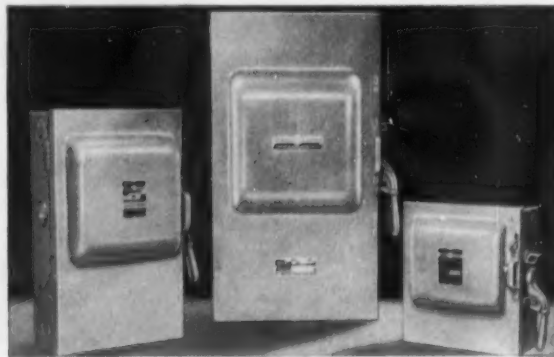
1. Have they proved themselves in years of tough service? Industry reports show that many Trumbull Style A heavy duty switches have given reliable service for over 30 years. Reasons? Such features as the heavy steel operating yoke that resist breaking and that insures opening and closing the switch. Strong fibre crossbar covers the yoke, maintains perfect blade alignment.



2. Will they operate coolly, efficiently? The impact-resistant slate base on Trumbull heavy duty safety switches rapidly bleeds off heat, so temperatures won't build up to dangerous levels. All copper current carrying parts are silver plated to eliminate oxidation and to further reduce temperatures. Maximum current is always carried because of heavy jaw pressures, sure fit.



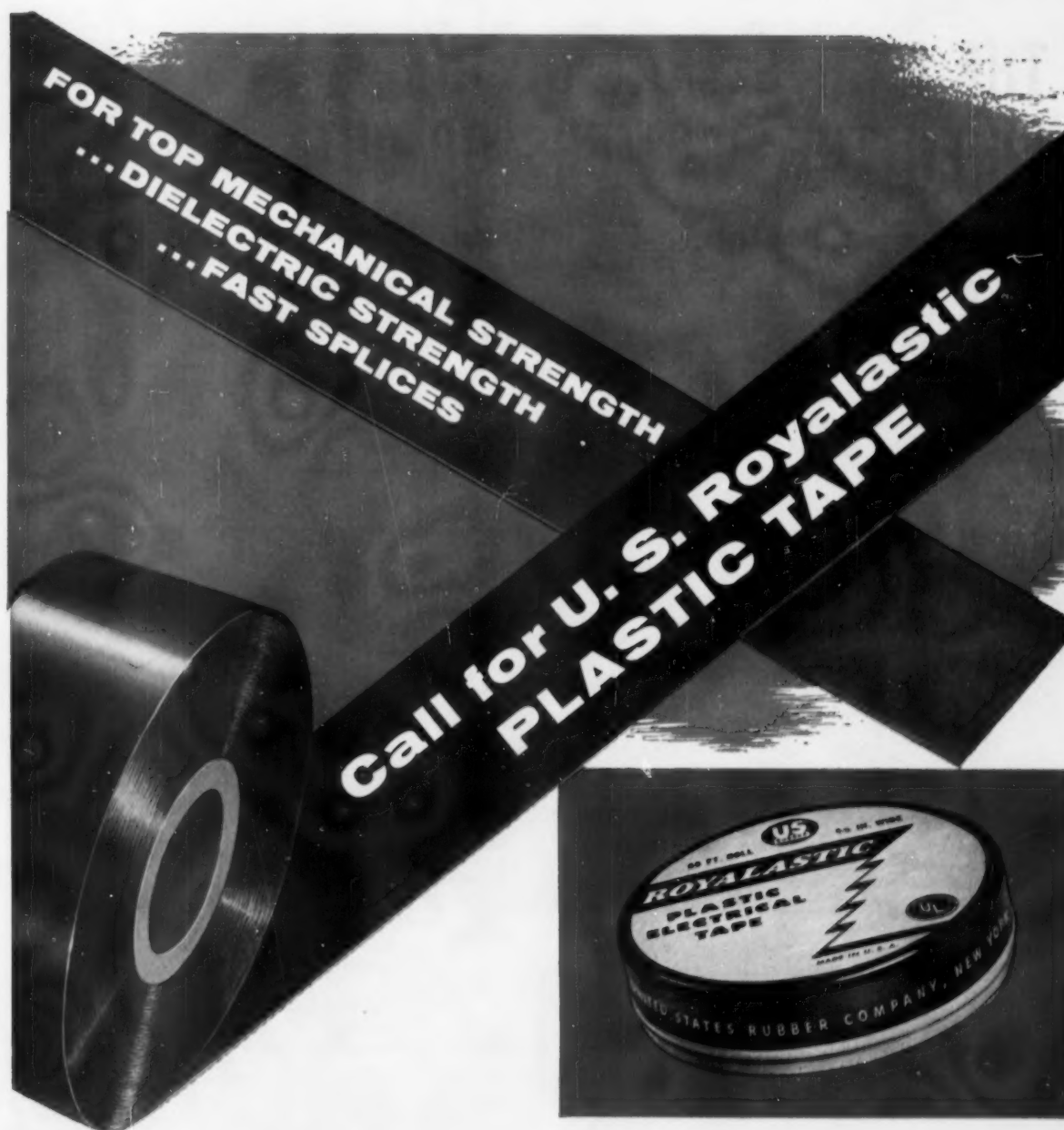
3. Are they quality made of rugged materials? Every Trumbull switch is made under severe quality control conditions using carefully selected materials. Hinge and jaw posts are milled, sweated and pinned (Type A construction) to stand up under tough abuse. Yoke bumpers eliminate jarring and the handle is of cast iron construction.



4. Can your plant standardize on them? Complete range of selection for every switch application makes it easy for your plant to standardize on Trumbull Style A heavy duty switches. Common parts, similar maintenance procedures reduce costs, electricians' time. Rated from 30 to 1200 amps and up to 600 volts. Single and double throw operation, 2, 3 or 4 pole design, either fusible or no fuse.

AVAILABLE FOR QUICK DELIVERY FROM YOUR LOCAL GENERAL ELECTRIC DISTRIBUTOR

GENERAL  ELECTRIC



Here's the tape that's made to order for complete mechanical and electrical protection. It is resistant to abrasion, water, oils, acids, alkalis and corrosive chemicals. Does the work of both rubber AND friction tapes in many applications. Makes a thin splice, keeps wiring neat and uncluttered. Good stretch, tight grip. Approved by Underwriters' Laboratories, Inc.

Royalastic tape is made by United States Rubber, the *only* tape maker to grow its own natural rubber and make its own synthetic rubber and plastics.

For instant supply, order from any of the many "U. S." distributors, any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

Watch NCAA football, Saturday afternoons, NBC-TV



Mechanical Goods Division

United States Rubber

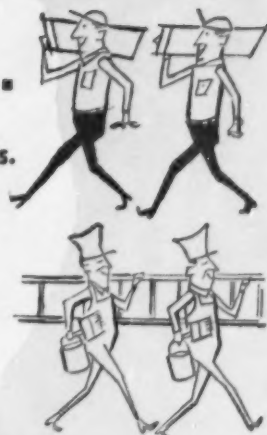
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . DECEMBER, 1956

THE LIGHTS THAT GO IN WHEN THE PAINTERS GO OUT...

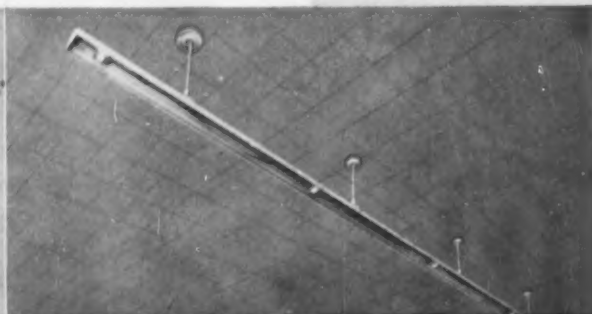
No On-Job Storage. No Paint-Spattered Fixtures. 50% Savings on installation costs.

Gibson ORTHO Fixtures need not be stored on the job where they're in the way of workmen and in danger of damage. Actually, Gibson ORTHO Fixtures can be delivered to the job the day before occupancy, because each fixture simply snaps into place in a matter of seconds, just as it comes from the box—sparkling clean, factory-fresh.

If you're interested in better lighting with savings of more than 50% on installation costs, then you really ought to know more about the Gibson ORTHO Line for industrial and commercial applications. Drop us a line. We'll send you the whole story.



1. WIRED ON THE FLOOR • A special channel (UNI-RACE) of telescoping 4' or 8' sections is assembled and wired on the floor, then lifted as a unit and mounted directly on joists, I-beams or stems. Saves hours of labor.



2. READY FOR THE FIXTURES • The UNI-RACE in place showing the built-in receptacles at 48" intervals. While the building is under construction, it will serve as a source of power for tools and temporary lighting.



3. SNAP—AND IT'S UP! • When the painters have left, the fixtures can be delivered to the building and snapped into place as fast as they are unboxed. Each fixture has a built-in plug which engages the receptacle in the UNI-RACE. Fixtures align themselves automatically.



4. VARIABLE SPACING • Fixtures may be installed in continuous rows or spaced at intervals of 4, 8, 12 or more feet. Units may be added, removed or rearranged any time without tools. Special "fill-in" sections close the UNI-RACE where no fixtures are mounted.



© AND PAT. PENDING

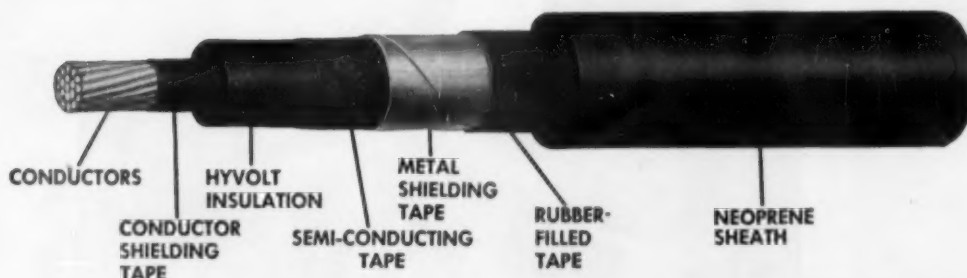




CRESCENT



HYVOLT SHIELDED POWER CABLE



For More Amperes Per Dollar of Installed Cost

ADVANTAGES

1. Long life
2. Can be operated at 85°C. Permits smaller conductors or more amperes per conductor.
3. Freedom from corona cutting
4. Excellent resistance to moisture
5. Low power factor and dielectric loss
6. Lighter, more flexible, easier to handle and install than lead covered cables
7. Electrolytic or chemical corrosion of lead sheath is eliminated by use of neoprene sheath
8. Shielding prevents possibility of surface burning and provides safety to human life.

CRESCENT HYVOLT insulation is made from butyl rubber which is inherently resistant to ozone, heat, moisture and aging. HYVOLT is formulated and processed so as to retain these inherent characteristics of the butyl rubber and at the same time provide excellent electrical and physical properties.

The insulation is protected during and after installation by an outer neoprene sheath providing a maximum degree of toughness, durability and long life. It is flame retarding and resistant to the deteriorating effects of moisture, sunlight, ozone (corona), oil, grease, and many acids and alkalis.

HYVOLT Shielding provides additional internal and external protection in these THREE WAYS

1. Conductor shielding, as provided by a semi-conducting tape over the stranded conductors, excludes air pockets between conductor and insulation and eliminates possible internal corona-cutting of the insulation.
2. The semi-conducting tape between the insulation and metallic shielding tape prevents possible ionization of air spaces and corona at the insulation surface.
3. The metallic shielding tape is grounded when installed, resulting in zero potential to ground at the sheath. It prevents surface discharge or burning, and protects cable from lightning surges. Reduces shock hazard.

RECOMMENDATIONS

CRESCENT SHIELDED HYVOLT CABLE is recommended for use in conduits, underground ducts, in wet or dry locations, or buried directly in the ground, for circuits operated at over 3000 volts and in accordance with I.P.C.E.A. recommendations. Available in single conductor or multi-conductor cables.

Specify CRESCENT SHIELDED HYVOLT POWER CABLE for general power circuits and where severe conditions are prevalent such as chemical plants, refineries, paper mills, mines, sewage disposal plants, etc. It is approved as Airport Lighting Cable Type B, CAA Specification L-824.

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON 5, N. J.

GUTH-LIGHT guards

**THE EYES
OF TEXAS!**



4,200
GUTH TROFFERS. ...ALZAK ALUMINUM LOWEST
LOW-BRIGHTNESS TROFFERS IN NEW
U.S.A.A. BUILDING, SAN ANTONIO



Texans think big and demand the best! That's why designers chose Guth Troffers for the magnificent new home office of United Services Automobile Association, San Antonio.

Their distinctive, custom-made look adds beauty to the contemporary decor... the shadowless, low-brightness lighting (with at least 65 ft. candles throughout) assures eye-ease and efficiency. What a combination!

And more: Guth's complete-unit design made the installation double-easy. No on-the-job assembly... they're ready to hang.

WRITE FOR GUTH TROFFER CATALOG NO. 50-A

ARCHITECTS: Phelps & Dewees & Simmons-Allee
B. & Robt. M. Ayres, San Antonio

ELECTRICAL DISTRIBUTOR: Southern Equipment Co., San Antonio

ELECTRICAL CONTRACTOR: Paul Wright Electrical Co., San Antonio

STRUCTURAL ENGINEERS: Matthews & Kenan, San Antonio and
Beretta, Greenslade, Clark & Collins, Inc., San Antonio

MECHANICAL ELECTRICAL ENGINEERS: Garard M. Baker, San Antonio,
and Beretta, Greenslade, Clark & Collins, Inc., San Antonio

THE EDWIN F.



COMPANY • ST. LOUIS 3, MO.

TRUSTED NAME IN LIGHTING SINCE 1902

GENERAL ELECTRIC ANNOUNCES THE MOST SIGNIFICANT DEVELOPMENT IN BALLAST DESIGN SINCE THE INTRODUCTION OF THE CERTIFIED SLIMLINE BALLAST

Important news for:

- **FIXTURE MANUFACTURERS**
- **ARCHITECTS**
- **CONSULTING ENGINEERS**
- **ELECTRICAL CONTRACTORS**

Progress Is Our Most Important Product

GENERAL  **ELECTRIC**

Read about this exclusive G-E ballast design achievement and the complete line
of G-E ballasts for slimline applications on the next 3 pages . . .

NEW G-E SHALLOW-HEIGHT BALLAST

**"Three years ago they said
it was impossible to
design this ballast!"**



But General Electric did it. A small group of General Electric Ballast Department engineers accepted the challenge. Result: the G-E 6G1010 shallow-height ballast. This new ballast is smaller, lighter, more efficient and better insulated than any other ballast now available for 430 ma 96T12 slimline two-lamp applications. Moreover, it's the quietest ballast of its rating on the market today.

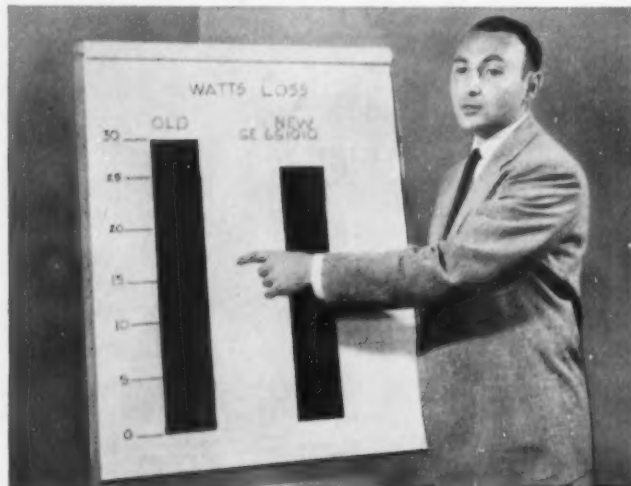
Electric and magnetic circuit innovations, the solu-

tion of heat transfer problems, and more efficient use of material and manufacturing technology helped to make this new design possible.

Dan Lovinger, Project Engineer of the General Electric Ballast Department, was one of those primarily responsible for the successful completion of the new design. In an interview, Mr. Lovinger outlines the features which make the 6G1010 the smallest, quietest, most efficient shallow-height ballast of its kind.



SMALLEST SIZE "The new 6G1010 shallow-height ballast is only 1 $\frac{11}{16}$ " high by 3 $\frac{1}{4}$ " wide—this, we think, is the optimum cross-section—with an over-all length of 11 $\frac{3}{4}$ " and a mounting length of 11 $\frac{1}{4}$ ". That's small for a ballast of this type. It means fixture manufacturers and architects gain the ultimate in design freedom. We've reduced the weight of this new ballast, too. But rated light output, starting current and open circuit voltage have all been maintained in accordance with CBM specifications. Engineering innovations, improved manufacturing technology, and more efficient utilization of material made today's General Electric 6G1010 certified ballast possible."

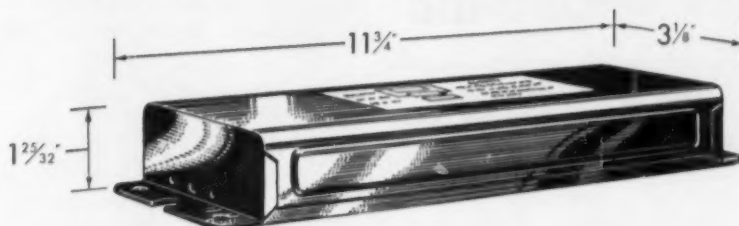


MOST EFFICIENT "Besides being the smallest size, the new 6G1010 ballast is also the most efficient ballast of its type. This high efficiency, achieved through certain design innovations, results in the lowest watts loss and operating temperatures known in the industry for a certified two-lamp 96T12-430 ma ballast. The watts loss value in the 6G1010 is only 26 watts. Because of this reduction in watts loss, we were also able to obtain low operating temperatures. Thus, greater design flexibility is possible for fixture manufacturers and architects which, to the ultimate user, means more efficient, more economical lighting applications. Low operating temperatures mean longer ballast life, too."

FOR 96T12 TWO-LAMP APPLICATIONS

You get four big advantages with the new General Electric 6G1010 shallow-height ballasts

- | | |
|-------------------|-----------------------|
| 1. SMALLEST SIZE | 3. NEW INSULATION |
| 2. MOST EFFICIENT | 4. QUIETEST OPERATION |



GENERAL  ELECTRIC



NEW INSULATION "We've also incorporated the best insulation system possible into our new 6G1010 ballast design. This new system includes the replacement of hygroscopic (water absorbing) insulation with Mylar* insulation and the introduction of nylon coated wire. Mylar insulation and nylon coated wire give greater dielectric strength and offer longer life characteristics. We've run field and laboratory tests which show that heat aging characteristics for nylon coated wire are far superior to any class "A" insulated wire for ballast applications. To supplement this excellent insulation system, the core and coil is pressure vacuum treated to give still greater dielectric strength and longer life."

*Registered Trade-mark of the DuPont Co.



QUIETEST OPERATION "The 6G1010 ballast offers the lowest sound rating in the history of two-lamp 96T12-430 ma ballasts under the exclusive G-E sound rating system. This is an extremely important feature and—we feel—a real achievement. The new G-E ballast is rated "C" which is at least one rating better than any two-lamp 96T12 ballast on the market. The developments which made this possible include the three piece core assembly with special push-on clamps, reduced core length, filling of shunt gaps with cement, special coil wedges, and our lift-pour with potting compound. Through these developments, we have been able to control and reduce vibration—the principal noise-causing factor.

WITH THE ADDITION OF THE 6G1010, GENERAL ELECTRIC INTRODUCES THE FIRST

COMPLETE LINE OF SHALLOW-HEIGHT BALLASTS FOR SLIMLINE APPLICATIONS

- Standard 1-25/32" height allows greater fixture design flexibility
- One to four pound weight savings across complete line

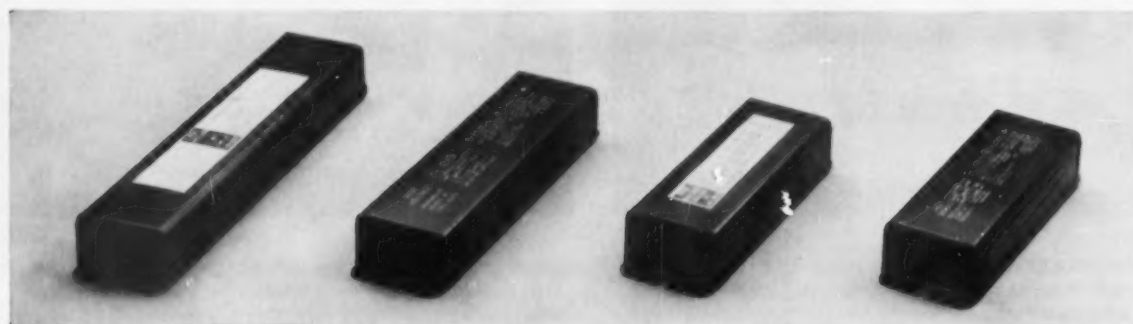
General Electric's complete line of shallow-height ballasts for slimline lamp applications enables fixture manufacturers to standardize on a shallower fixture channel. The shallow-height—1 $\frac{11}{32}$ inches—as well as the generally smaller over-all dimensions makes possible greater design flexibility in fixtures and in architectural planning.

Weight reductions—ranging from one to four pounds—allow savings on fixture shipping costs. Mylar insulation and nylon coated wire give greater dielectric strength and longer life to all ballasts in this complete line. Quieter operation and increased efficiency are two other factors which can't be overlooked when specifying or ordering ballasts for slimline applications.

Choose the General Electric shallow-height ballast to fit your specific requirements. All units, of course, incorporate all of the General Electric standard "Quality" features—Exclusive Sound Rating System, Superior Quality Control, Longer Ballast Life, Lamp-Matched Design, Proved Product Leadership, Complete Customer Services.

For more information on the complete shallow-height line and all other G-E ballasts, write for bulletin GEC-983 to Section 401-32, General Electric Company, Schenectady 5, New York; or call your nearest G-E Apparatus Sales Office.

Catalog number	6G1010	89G600	89G662	89G693
Lamp types	96T12	48T12	96T12	48T12
Number of lamps	2	2	1	1
Circuit voltage	110-125	110-125	110-125	110-125
Frequency	60 cycles	60 cycles	60 cycles	60 cycles
Watts loss	26	20	27	20
Sound rating	C	D	D	D
Over-all length	11-3/4	9-1/2	14-5/16	9-1/2
Mounting length	11-9/64	8-57/64	13-3/4	8-57/64
Height	1-25/32	1-25/32	1-25/32	1-25/32
Weight (lbs.)	8	5-1/2	9-1/2	5-1/2
Weight savings (lbs.)	1-1/2	2-3/4	1/2	4+



89G662

6G1010

89G693

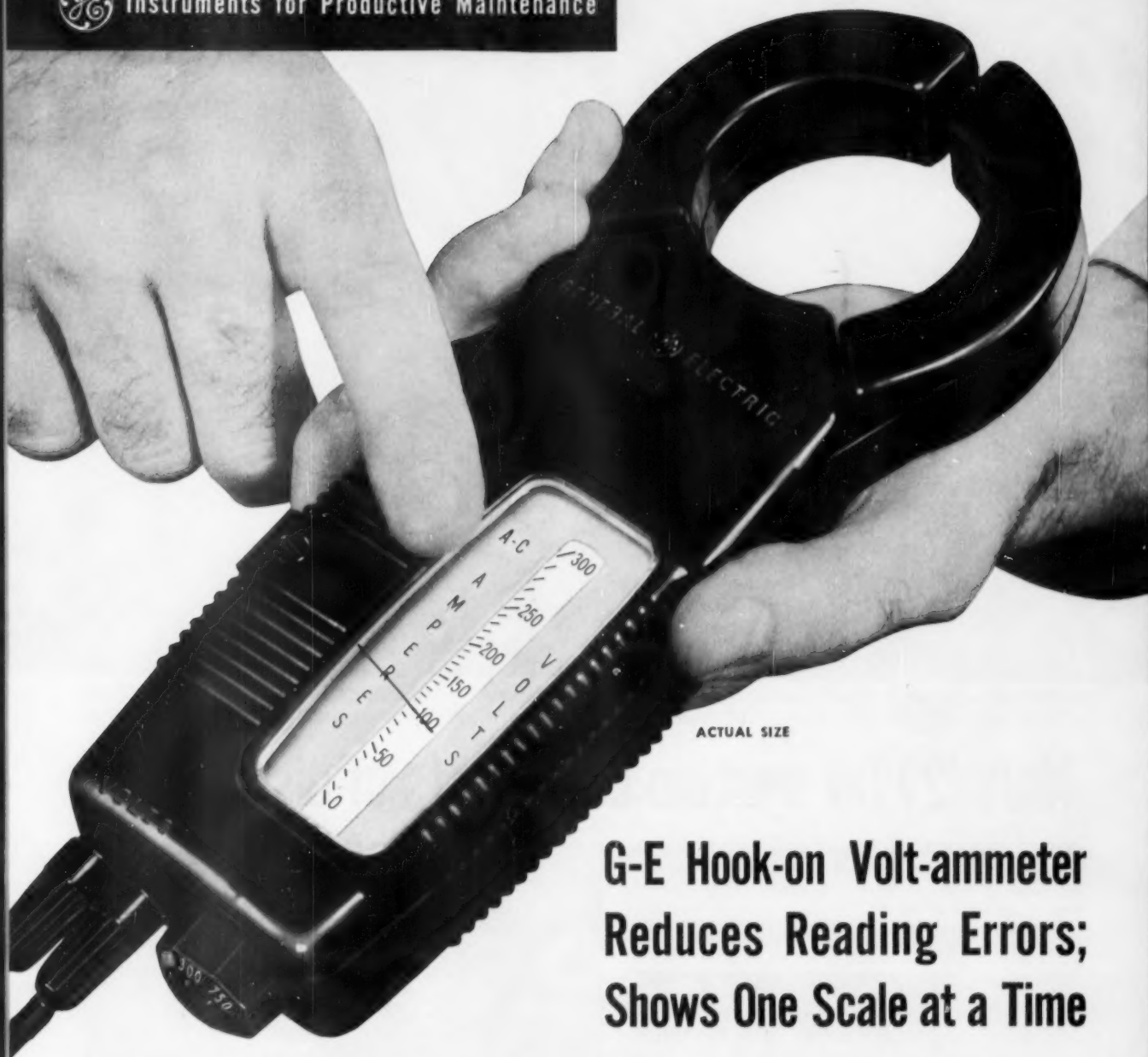
89G600

Progress Is Our Most Important Product

GENERAL  ELECTRIC



Instruments for Productive Maintenance



G-E Hook-on Volt-ammeter Reduces Reading Errors; Shows One Scale at a Time

GENERAL ELECTRIC'S hook-on volt-ammeter shows only one scale at a time. You simply select the desired range and only the corresponding scale is visible. This eliminates the possibility of reading the wrong scale, as can be done with multiple scale face instruments. The range and scale of this G-E instrument are changed simultaneously by turning the finger-tip control knob. The two models of the instrument are designated Types AK-4 and AK-5, and both have current scales marked in black and voltage scales marked in red.

USED BY contractors, electricians, engineers, maintenance and servicemen, the G-E hook-on is ideal for

balancing circuits and tracing faults and grounds without shutting down equipment.

WIDE RANGES are available in both models of the G-E volt-ammeter. Ranges of the AK-4 model are 0-10/30/-100/300/800 amperes and 0-150/300/750 volts. The AK-5 ranges are 0-5/20/80/350 amperes and 0-150/-300/750 volts. The wider range AK-4 model has a pointer-stop to check surge readings.

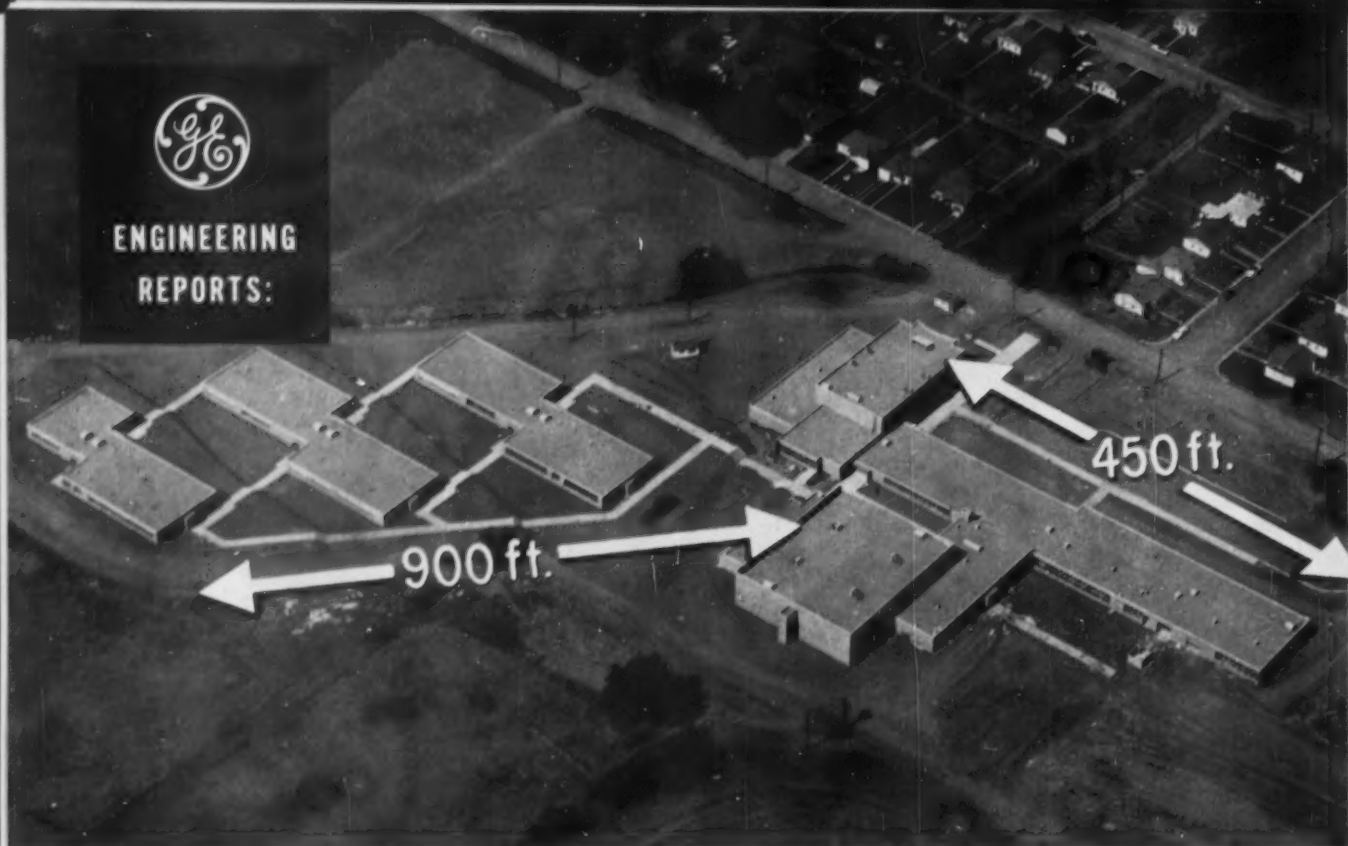
FOR FURTHER INFORMATION, write section 582-10, General Electric Co., Schenectady 5, New York and ask for bulletin GEA-6292, or contact your nearest G-E Apparatus Sales Office.

Progress Is Our Most Important Product

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ENGINEERING REPORTS:



DIMENSIONS INDICATE distances electrical feeders must travel to serve loads at new Golden High School. Higher-voltage

distribution systems can reduce cost per room of many rambling-style buildings—make school building dollars go farther.

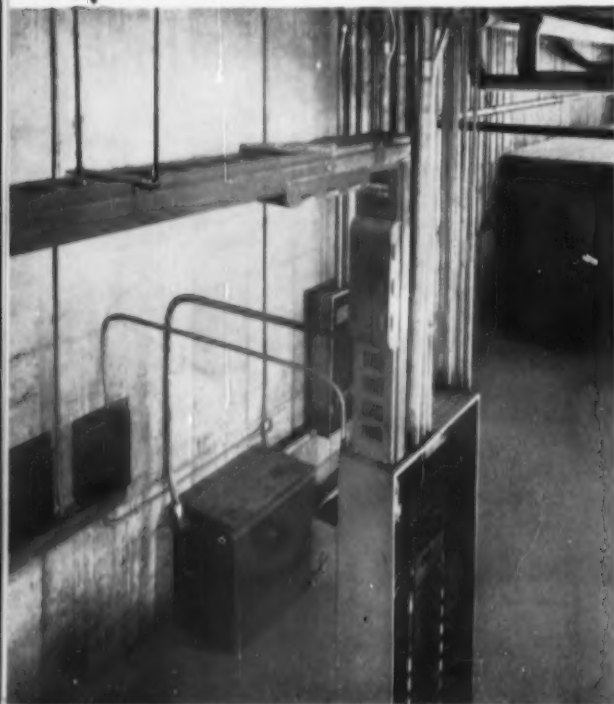
480Y/277-V system cuts costs of distributing

SERVICE ENTRANCE has Type-LVD, low-voltage-drop busway carrying incoming power to Type-CCB panelboard (front removed) where molded-case breakers help protect system and feeders. Efficient, Type-D, dry-type transformer economically supplies needed 120/208-volt power for this part of school.



LOAD AREAS are served by 480/277-volt, Type-CCB panelboards which help protect control branch circuits. Small inexpensive, Type-M transformers supply whatever 120/208-volt power is needed.

LIGHTING CIRCUITS are controlled by Type-NHB panelboards. Sturdy, safer G-E panelboards are available for every application.





HIGHER-VOLTAGE, 265-volt fluorescent lighting makes up large part of load, provides light level of 64 footcandles in classrooms.

Standard lamps are used throughout school with 265-volt ballasts and are controlled by 277-volt conventional snap switches.

power over long distances in new high school

Golden, Colo. High School features General Electric equipped system as most economical for serving widely spread loads of "campus-type" design

When planners of Golden, Colorado's new high school decided on a modern, campus-type design they were faced with distributing electric power over long distances to serve all locations of the "campus." These long feeders make 480Y/277-volt distribution a natural, and General Electric was selected to supply equipment for such a system.

SAVINGS OCCUR with higher voltages if 30 to 50 per cent of load can use 480- or 277-volt power or when

feeders average at least 200 feet. At Golden, feeders up to 900 feet long and the use of 265-volt fluorescent lighting made the system a much more economical choice than conventional lower voltages.

Since voltage drop is less and feeders and circuit breakers can serve larger kva loads at higher voltages, the school's builders made substantial savings in the size and number of conductors and breakers serving their 225-kva load. This saving helped reduce over-all cost of the school and prompted the Board to recommend this system for two additional new schools.

G-E ENGINEER, M. S. Harris (R) helped throughout project. Here he confers with (L-R) W. A. Barr of Buell & Co., architects; G. R. McCormack, Construction Engineer of Jefferson County Schools; T. Howard of Howard Electric Co., contractor.



ENGINEERING ASSISTANCE was made available to the school, its consultants and contractors by General Electric engineers, trained and skilled in application of higher-voltage systems. The same assistance and highly reliable equipment are available to help you in your next building project. Contact your nearest G-E Apparatus Sales Office for more information on 480Y/277-volt systems, or send for Bulletin GEA-6344, General Electric Co., Sect. 680-5, Schenectady, N. Y.

**Engineered Electrical Systems for
Commercial Buildings**

GENERAL  ELECTRIC



Wagner Increment-Start Motor drives grain company hammer mill

**Eliminates "across-the-line" starting... reduces voltage drop...
brings 100 hp motor to full speed in 12 seconds!**

They said "it can't be done... an increment-start motor will not pull the load." But grain company operators from Eastern Tennessee and Kentucky are seeing for themselves how Jones Grain Company's new automatic hammer mill installation with a Wagner Increment Motor and Starter Combination *does* the job—efficiently and economically. The 100 hp motor starts quickly and easily with minimum voltage drop and line disturbance. The two-step motor and starter combination brings the motor to full speed on the second stage in 12 seconds.

Wagner Motors with Increment Starters are far less expensive than motors with primary resistance or auto-transformer type starters... yet fully meet the poly-

phase motor starting recommendations of AEIC-EEI-NEMA. Wagner two-step motor and starter combinations are suitable for most applications. For installations where unusually low inrush of starting current is required, Wagner can furnish 3, 4, 5, or 6 step increment motor-starter combinations.

Why don't you investigate the possibilities for savings by using Wagner Increment-start Motor Combinations on your big jobs? Your nearby Wagner engineer will help you select the increment motor and starter combination that meets your requirements. Call the nearest of our 32 branches or write for Bulletins MU-128 and MU-195.



Type RP polyphase motor in ratings to 400 hp with increment type starter



M56-11

...to help America **LIVE BETTER**—Electrically

Wagner Electric Corporation

6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.



BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . DECEMBER, 1956



Now available from your jobber!

Reg. U.S. Pat. Off.
SCOTCHLOK Type R
BRAND
Electrical Spring Connectors

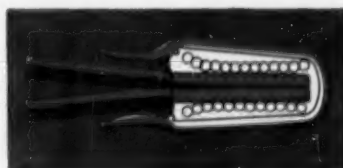
With "live" Spring Action... Strong... Fast... Pre-Insulated!

"Scotchlok" Type R — the *red* connector with the *real* holding power — takes all common wire combinations from #10 to #16 AWG... the widest range of any connector!

New "SCOTCHLOK" Type R is the same tight-holding construction as regular "SCOTCHLOK" — and it's pre-insulated!



After wires are inserted, the *live* spring action seizes them in a bulldog grip — a *live* spring action that no amount of vibration or jerking can jar loose!



SEND FOR FREE SAMPLES! See for yourself how good "SCOTCHLOK" Brand Type R Connectors really are! Just write on your letterhead and we'll send you free samples for testing.
 Address: 3M Company, St. Paul 6, Minn., Dept. CB-126.

The term "SCOTCHLOK" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P. O. Box 757, London, Ontario.





Announces Convenient New TIME PAYMENT PURCHASE PLAN



1 For one-man portability, you can't beat this 80 lb. Oster No. 142 "Featherweight Champ." But don't let its light weight fool you... it's built to take plenty of rough, tough work anywhere there is threading to be done.



2 Here's the threading machine that just never wears out. Oster offers the rugged No. 432 "Lightweight Champ" with full confidence that it will save you money. It's easy to move... easy to use... literally the standard for all types of users.



3 For more continuous use, specify the new Oster No. 552 "Pipe Master." Here's a complete portable pipe and bolt threading machine with "Auto-Grip" front chuck... quick-opening, adjustable, floating-type Die Head... revolving, rear-centering chuck.



4 For the ultimate in pipe and bolt threading performance, it's the revolutionary Oster No. 582 "Tom Thumb" Portable Pipe Machine. Has built-in Thread Length Gauge, Cut-Off Device and Length Gauge... equipped with two quick-opening, fully adjustable die-heads.



5 Here's a real time-saver... a proved profit-maker, too! It's the rugged, handy Oster No. 420 "Sewer Master", the machine that makes short work of clogged drains and sewers. Easily and quickly removes obstructions 100 feet or more from sewer entrance.

Now...
*Pay as
You Profit*
with
OSTER

*After minimum down payment... based on 12 monthly payments.

Now... Oster makes it possible for you actually to pay for any Oster machine out of the profits which it earns for you. Under this new Oster Financing Plan, any Oster machine can be yours for only 25% of its regular list price, plus state tax, if any. Payments may be made over periods of 3, 6, 9 or 12 months, as you desire.

For complete information and terms on the Oster machine of your choice, see your nearby Oster Selective Distributor, or write direct to our main office.



For other Models
write for General Catalog

THE OSTER MANUFACTURING CO., 1313 EAST 289TH ST., CLEVELAND (WICKLIFFE), OHIO

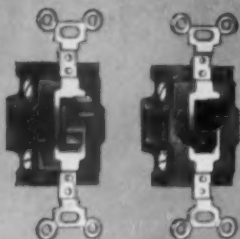
FOR DEPENDABLE SERVICE

ON HEAVY DUTY JOBS

P&S

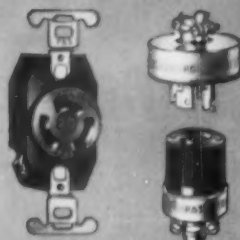
THE BEST
COMES FROM **P&S**

Over 65 years of leadership in the wiring device field have taught the industry to look to Pass & Seymour for the Precision Manufacturing and Creative Engineering that means stronger, longer-lasting, simpler-to-use wiring devices.



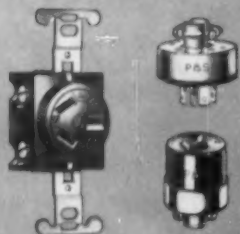
P&S SUPER AC SWITCHES

Pass & Seymour-engineered for extra long life on HEAVY DUTY service. P&S Super Switches can be used at full rated capacity on fluorescent, incandescent, and inductive loads, and can control motor loads up to 80% of switch rating. Rated 15 and 20 amperes, 120 Volts A.C. to 277 Volts A.C.



P&S TURNLOK® LINE

Heavily armored caps . . . sturdy, two piece bodies for longer life. Easy back or side wiring. Available in 10 and 20 amperes — 2, 3, and 4-wire types. Modern face design plainly indicates ampere ratings on all receptacles.



P&S POLARIZED DEVICES

Extra heavy bodies and extra heavy metal parts withstand hardest wear for longer periods of time. All receptacles have extra design features to make installation easy and quick. Available in 10 and 20 amperes — 2, 3, and 4-wire connectors, receptacles and caps.

For wiring device quality, always look for these outstanding devices.
The original Despard Line®
P&S Surfex®
Roto-Glo® Switches
Uniline® Wall Plates
Alabax® Fixtures
Complete line of Switches, Outlets and Lampholders

Every year, more Pass & Seymour wiring devices are sold. The strength, durability and, most important, the speed and simplicity of installation of all P&S products make them the specified choice of electrical contractors everywhere.

Write Dept. ECM-21 for full listings and descriptions of these and all other types of wiring devices in the complete quality Pass & Seymour line. For accuracy's sake—order only by P&S catalog number.

P&S

PASS & SEYMOUR, INC.

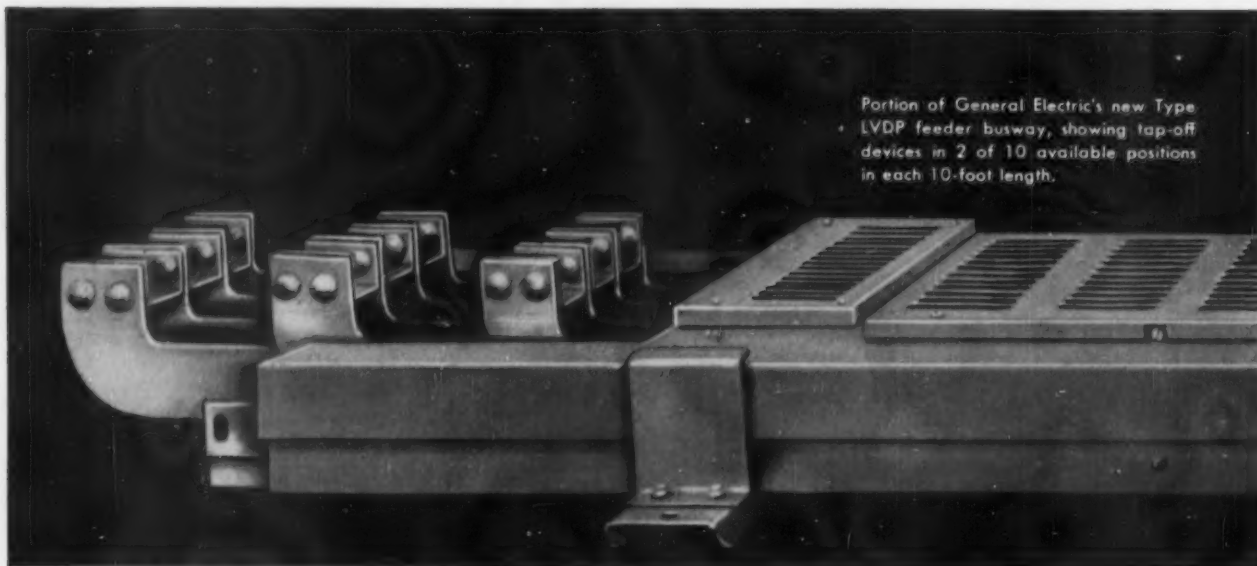
SYRACUSE 9, NEW YORK

71 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.

In Canada: Renfrew Elec. & Refrig. Co., Ltd., Renfrew, Ontario

New development from General Electric

Plug-in Flexibility + Low Voltage Drop + High



Portion of General Electric's new Type LVDP feeder busway, showing tap-off devices in 2 of 10 available positions in each 10-foot length.

New plug-in busway, with tap-offs at one-foot intervals, carries large blocks of power (600 to 4000 amperes) with virtually no voltage drop penalty!

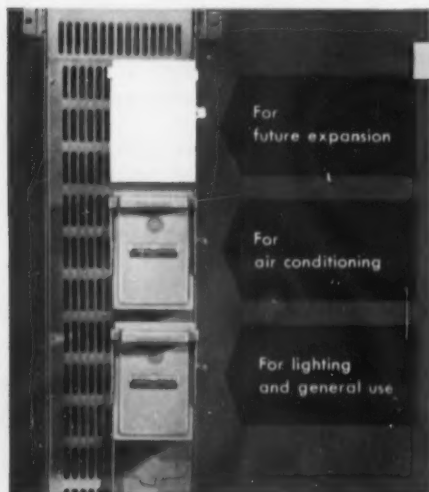
A major advance in busway design, the LVDP busway lets you . . .

- install a primary feeder system at less cost than ever before
- lower (and often eliminate) subsequent relocation expense

Industrial plants can now relocate tap-off connections in minutes instead of hours. If equipment such as welders must be moved (no matter how frequently), you merely

disconnect your plug and reinsert it at a more convenient place—almost as easily as you do with your toaster at home. You do not have to disassemble and reinstall major busway sections as before.

Commercial buildings are no longer limited to one tap-off per floor. You get the convenience of individual metering for each tenant without adding extra equipment. As requirements grow, you can increase power available to each floor by simply plugging in additional tap-offs.



LOWER INITIAL COST

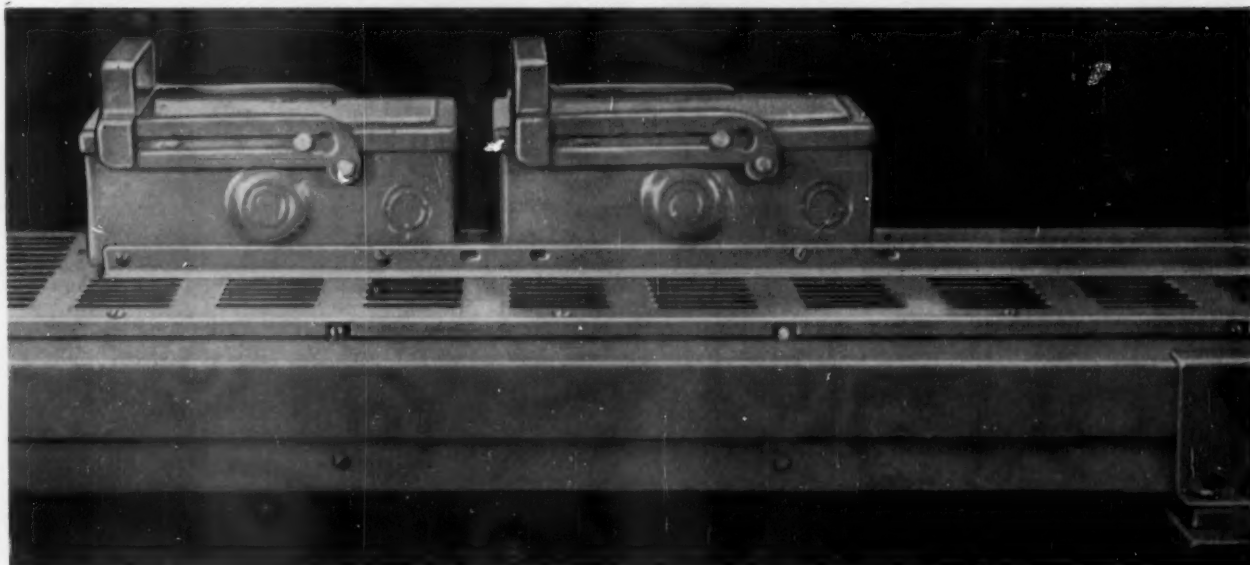
Eliminate hard-to-install cable tap-off box and separate protective device and substitute a simple plug-in combination tap-off and protective device.

LOWER REMODELING COST

Now you can relocate equipment or add new equipment without doing anything more than unplugging the tap-off and reinserting it at a more convenient place.



Capacity—Now in One Feeder Busway!

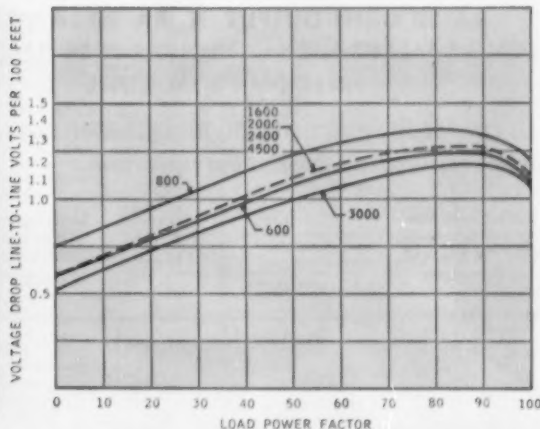


PLUG-IN FLEXIBILITY: Rated from 600 to 4000 amperes, the Type LVDP plug-in busway comes in ten-foot sections, each with ten tap-off points for subfeeding through standard General Electric Flex-A-Plug* switch units. Outlets are shielded to prevent accidental contact with bus bars.

LOW-COST INSTALLATION: LVDP sections match up with G.E.'s Type LVD feeder busway (similar low-voltage drop, same capacity). When plug-in flexibility is desired, use the LVDP. When no taps are needed, you can select lower-cost LVD busway—straight sections, turns and end boxes.

*Registered trade-mark of The General Electric Company.

Call your General Electric representative and have him give you all the facts for your next job.
Or write Distribution Assemblies Department, General Electric Company, Plainville, Conn.



Between the point at which power is brought in and the end of the main feeder, voltage drops of eleven percent and more frequently occur, as shown by a recent survey. The chart at left shows the extremely low voltage drop of General Electric's new Type LVDP plug-in busway with aluminum conductors.

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GENERAL  ELECTRIC

HERE'S WHY

CERTIFIED  BALLASTS

ENJOY A PREFERENCE OF NEARLY

2 TO 1

In 1955, nearly 2 out of 3 HPF ballasts
were CERTIFIED CBM BALLASTS.

There is just one reason for this preference:

CERTIFIED CBM BALLASTS assure more satisfactory and economical
fluorescent lighting.

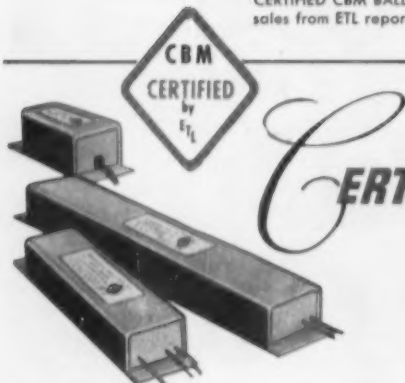
Built to exacting specifications that provide the precise electrical needs of fluorescent lamps, and periodically checked by Electrical Testing Laboratories, Inc., CERTIFIED CBM BALLASTS are your assurance of:

**RATED LIGHT OUTPUT • RATED LAMP LIFE
LONG BALLAST LIFE • TROUBLE-FREE OPERATION
FREEDOM FROM NOISE**

... all contributing to better lighting, lower maintenance cost
and more economical fluorescent operation.

*Total ballast sales from
U. S. Dept. of Commerce.
CERTIFIED CBM BALLAST
sales from ETL reports.

Send for free booklet,
"Why It Pays to Use
CERTIFIED CBM BALLASTS
in Fluorescent Lighting
Fixtures".



CERTIFIED BALLAST MANUFACTURERS
2116 KEITH BUILDING • CLEVELAND 15, OHIO

Seven of the country's leading manufacturers
of ballasts make
CERTIFIED CBM BALLASTS.
Participation in CBM is open to any
manufacturer who wishes to qualify.

FIRST

with a
COMPLETE LINE
OF
SAFETY
SWITCHES
to meet the
NEW NEMA
STANDARDS

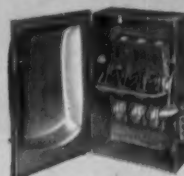


• The table below shows Square D switches meeting new industry specifications. Notice how they clarify conflicting features which existed under old designations. Notice, too, that they establish a new, heavy-duty industrial switch, Type HD.

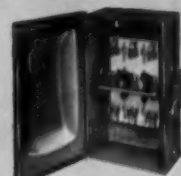
One important thing which remains unchanged is the **DESIGN LEADERSHIP** which has made **SQUARE D SAFETY SWITCHES** industry's overwhelming **FIRST** choice for more than fifty years. Compare them, feature for feature. They cost no more, why settle for less?



TYPE HD



TYPE ND



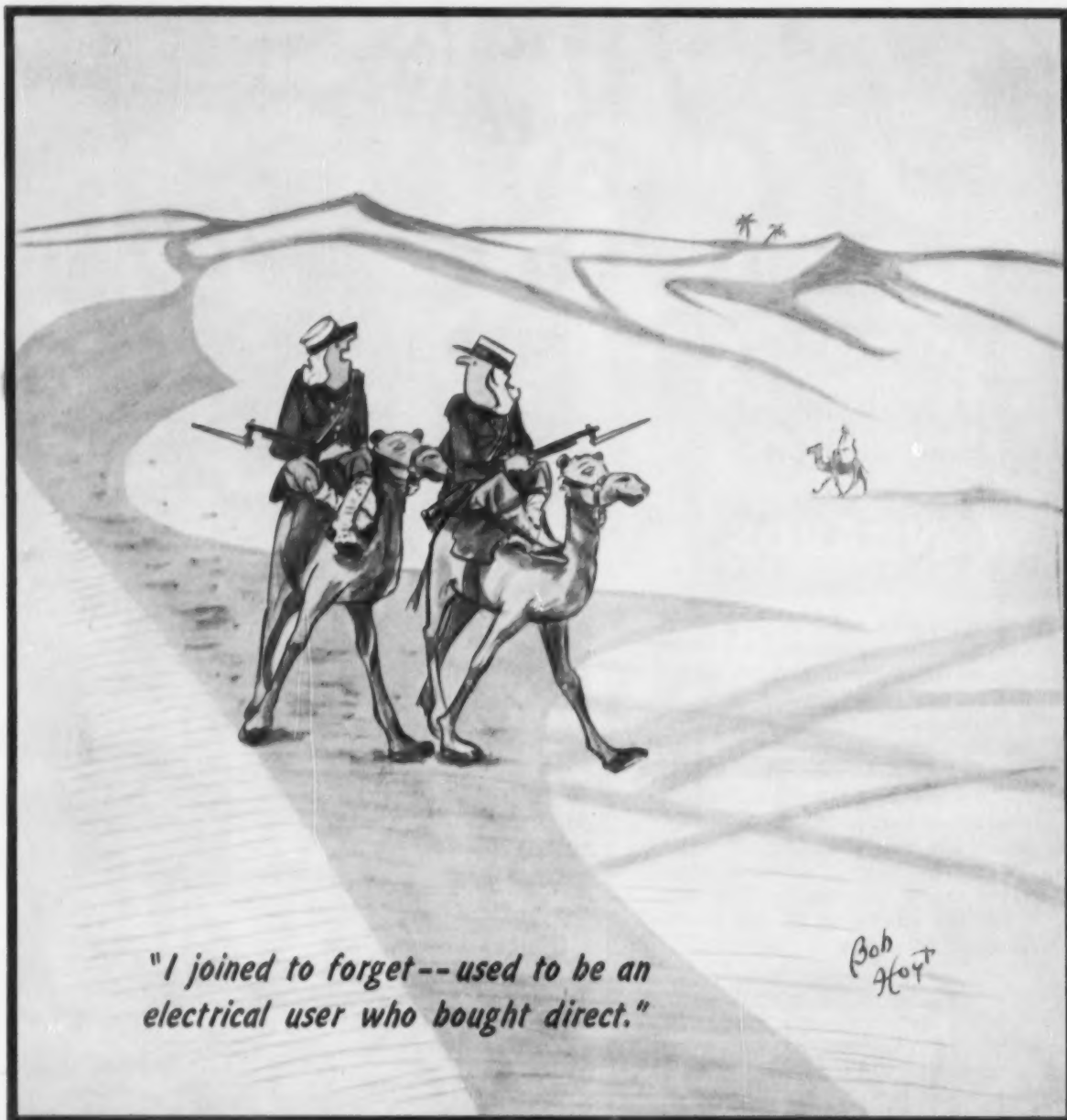
TYPE LD

DESCRIPTION	HEAVY DUTY New	NORMAL DUTY formerly Types H, S, or A	LIGHT DUTY formerly Types D or G
Rating-Ampere Voltage	30-600 250 or 600V AC, DC	30-1000 250 or 600V AC, DC	30-200 250V AC
Enclosure	NEMA 12 - Industrial Use (Gasketed) NEMA 4 & 5 - Water-tight & Dust-tight NEMA 7 - Explosion-resisting Class I-Group D NEMA 9 - Explosion-resisting	NEMA 1 - General Purpose NEMA 3R - Raintight	NEMA 1 - General Purpose NEMA 3R - Raintight
Horsepower Rating	NEC Fuse Ratings Dual-Element Fuse Ratings	NEC Fuse Rating Dual-Element Fuse Ratings	NEC Fuse Rating
Operating Mechanism	Quick-Make, Quick-Break Independent of Handle	Quick-Make, Quick-Break Independent of Handle	Positive Make, Positive Break Spring Assisted
Cover	Interlocked & Padlock Attachment	Interlocked & Padlock Attachment	Padlock Attachment
Plating-Current Parts	Extra-Heavy Silver	Silver	
Endurance	Maximum Endurance Far Exceeds UL Standards	Exceeds UL Standards	Meets UL Standards



NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY



*"I joined to forget--used to be an
electrical user who bought direct."*

"Electrical Wholesaler Distribution reduces the Manufacturer's selling cost and thereby reduces the selling price of electrical supply material to the user. Therefore, our policy has been to distribute Thomas & Betts products exclusively through the Electrical Wholesaler."*

LOOK FOR THIS SIGN —



IT'S THE MARK OF AN AUTHORIZED **T & B** DISTRIBUTOR

*Quoted from the T & B Plan of Wholesaler Distribution. If you would like to know the complete story of the T & B Plan, write:

THE THOMAS & BETTS CO.
INCORPORATED

34 BUTLER STREET, ELIZABETH 1, NEW JERSEY
THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



**INCREASE SAFETY,
SAVE INSTALLATION
TIME AND COSTS with**



LEC-TROL-FEED

Now, you can install safe power for cranes, hoists, welding units and other straight-runway equipment faster and cheaper than ever before. The new LEC-TROL-FEED System is rugged, long-lived and designed for the ultimate in worker safety. It is preassembled with lightweight aluminum bus bars arranged and insulated to provide extra leakage distances for troublesome applications. A rugged trolley assembly is built for long, trouble-free life—even under extreme conditions.



UNIQUE SAFETY SLOT COVER FOR MAXIMUM PROTECTION

No contact with current-carrying bus bars at top and sides is possible. Bottom safety cover provides maximum protection against accidents at trolley arm entry. Built-in positive safety permits you to locate this LEC-TROL-FEED System where it is most convenient for efficient production.



ALUMINIZED HOUSING 30' LONG SPEEDS INSTALLATION

Standard 30' long track sections mean fewer joints, rigidity of track requires fewer hangers. Expansion sections are needed only at building joints. Completely enclosed . . . requires no rain shields outdoors. Every part is easily accessible and trolley is removable at any joint section.

For fast-action installation . . . safety-first power . . . and long-life service install LEC-TROL-FEED. Write today for complete engineering data and technical file.

Send For This Technical Data



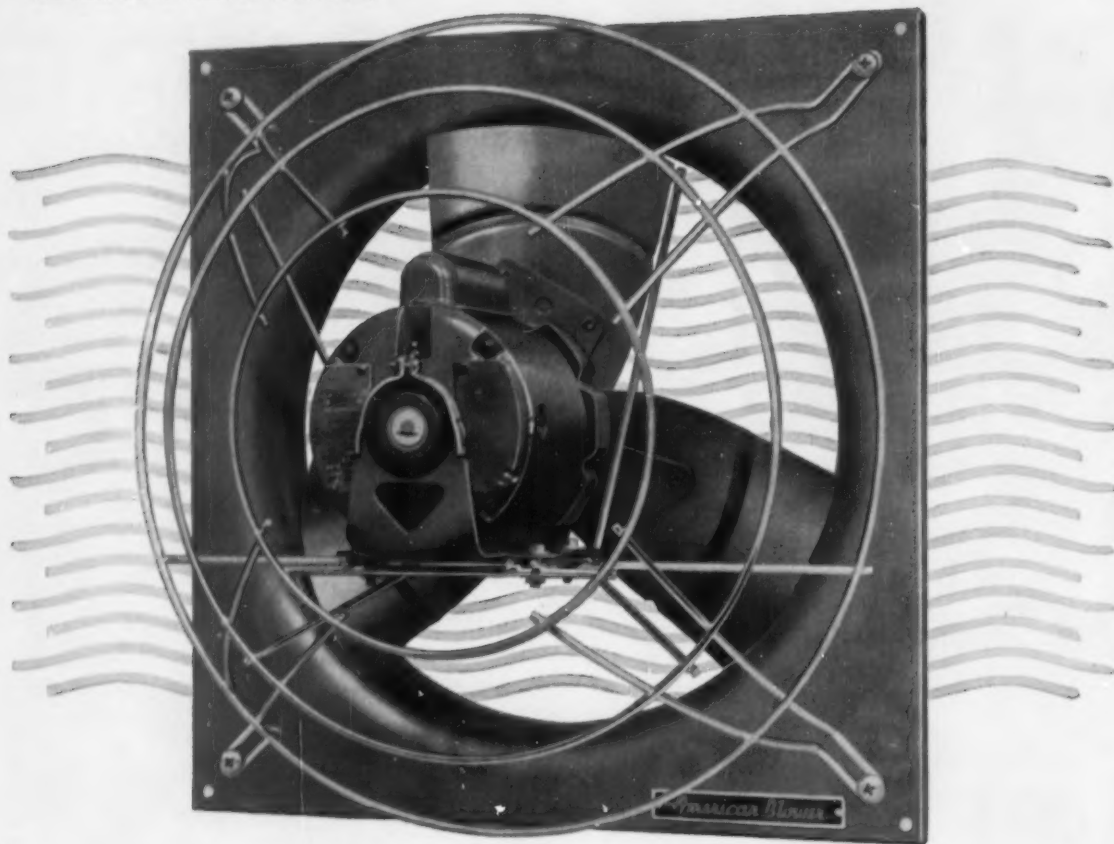
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Electric Service Works
DELTA-STAR ELECTRIC DIVISION, H. K. PORTER COMPANY, INC.

17th AND CAMBRIA STREETS, PHILADELPHIA 32, PA.





Streamline inlet gives higher efficiency, quieter operation

This is only one of many engineering and design features which make American Blower Ventura Fans a popular choice for all types of commercial and industrial applications—from cafeterias and laundries to sales rooms and warehouses.

Ventura Fans operate quietly as they whisk away stale air or fumes; have certified ratings; come in a wide range of sizes and models. Fact is: American Blower has a complete line of propeller fans—as well as blowers, attic fans, and home ventilators . . . a good reason why it pays to *standardize* on American Blower.

Why not call our nearest branch today for full information.

IT PAYS TO STANDARDIZE ON THE AMERICAN BLOWER LINE!

- **Ventura Fans** for efficient commercial and industrial ventilation; propeller type; 10 to 72 inches. Certified ratings.
- **Utility Sets** for general supply or exhaust duty. Ratings certified; self-contained. Sirocco wheels, 3 to 36 inches.
- **Aeropol Home Ventilators** for use in kitchens, bathrooms, recreation and laundry rooms. Attractive design; quiet; easy to install.
- **Attic Fans** for comfort cooling at low cost in homes, apartments, hotels. Ratings certified; vertical or horizontal models.

AMERICAN



BLOWER

Division of American-Standard

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

do rusty conduit threads cost more?



NO DOUBT ABOUT IT . . . SO PITTSBURGH STANDARD CONDUIT THREADS ARE HOT-DIP GALVANIZED

Cost for rigid steel conduit must be measured by both purchase price and labor cost for putting the conduit in place. If workmen's time must be spent in chasing rust from threads, then you pay more—make less on the job. That's the reason Pittsburgh Standard gives you hot-dip galvanized threads on hot-dip galvanized conduit *on every size through 6-inches*. And because Pittsburgh Standard owns the world's most modern conduit mill, these hot-dip galvanized threads come to you at *absolutely no extra cost*. This is a major advance—company after company is rewriting specifications to call for Pittsburgh Standard Conduit. Available from your Pittsburgh Standard wholesaler, or write *Pittsburgh Standard Conduit Co., 61 Bridge St., Pittsburgh 23, Pa.*

PLANTS AT MORRISVILLE & ETNA, PA.

RIGID STEEL CONDUIT • ELECTRICAL METALLIC TUBING • ELBOWS • COUPLINGS • FITTINGS

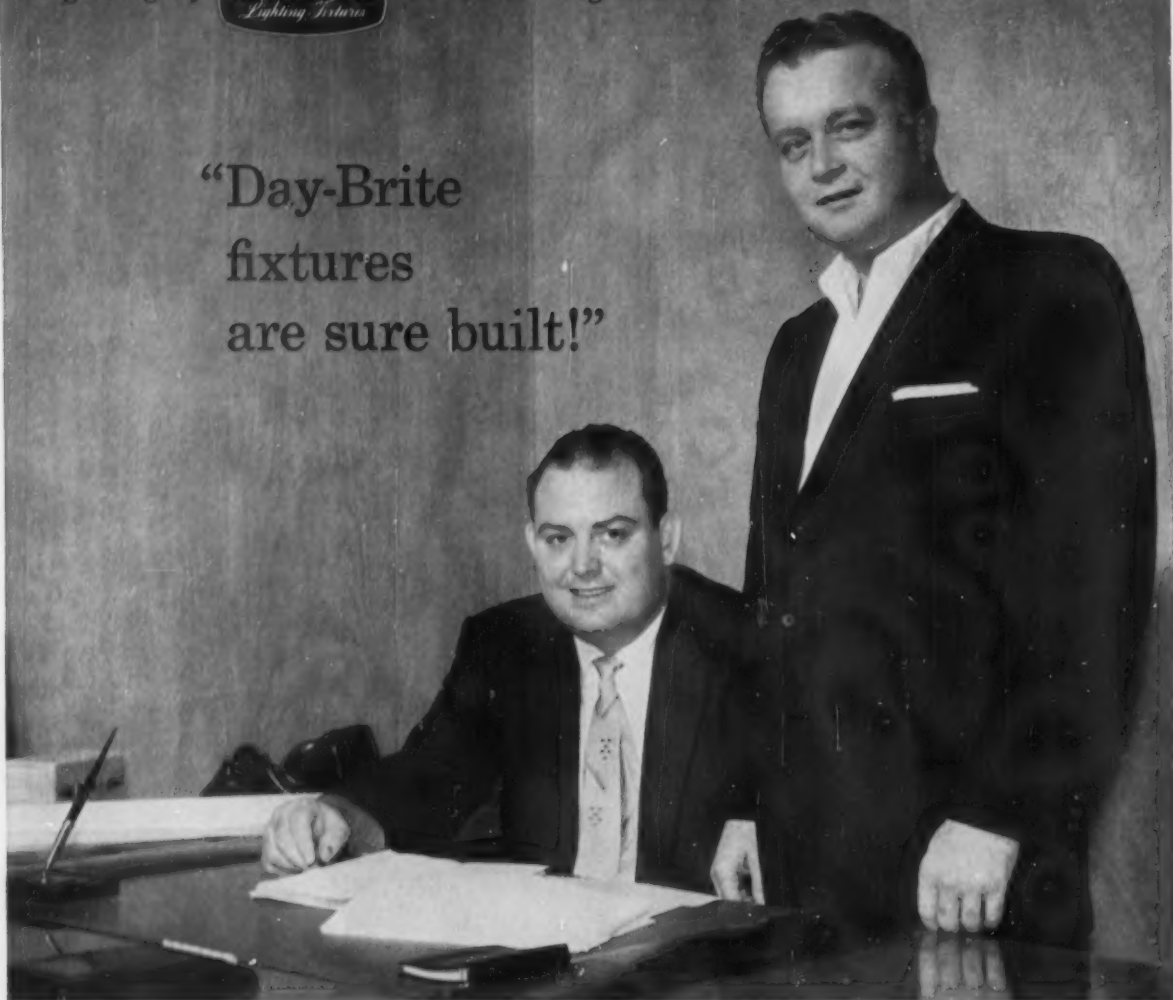


Lighting by



makes the big difference . . .

**"Day-Brite
fixtures
are sure built!"**



Mr. Vernon Walters and Mr. H. A. Roehling of Walters Electric Co., Los Angeles, Cal.

"We're very happy with Day-Brite fixtures—they are really built. They're quality construction all the way, even to the smallest detail. That means a lot to us. They go up better, quicker—give us no trouble in installation—maintenance is easy and inexpensive—everybody's happy!"

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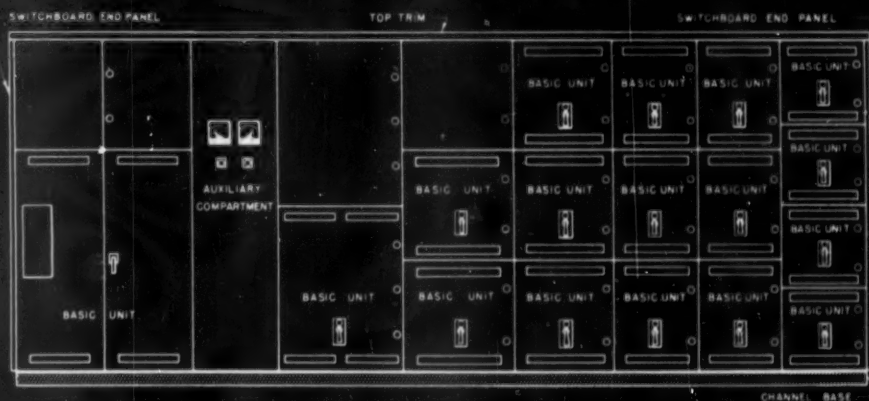


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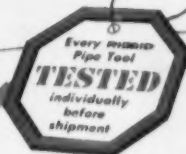


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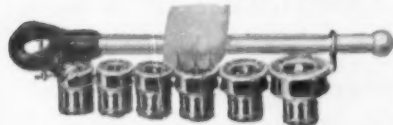
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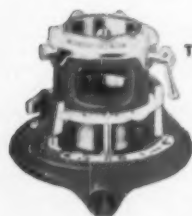


Carrier Free with Sets

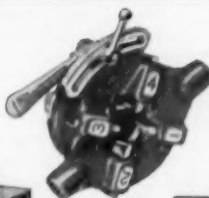
Bolt Threaders, too—ask for **RIDGID OOR-B**, same easy-work advantages as drop-head pipe dies.



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Threads 1" to 2" pipe
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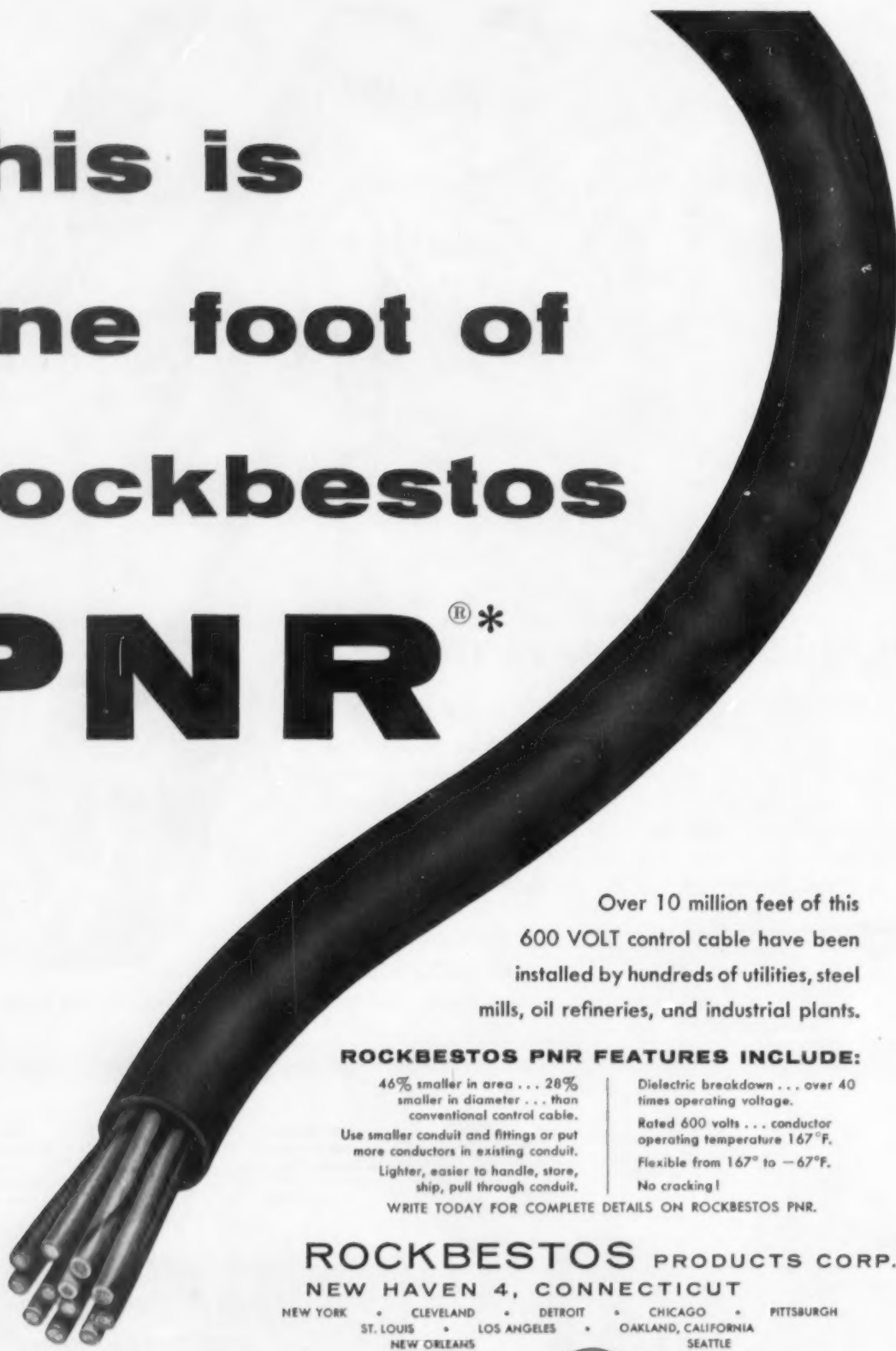
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*P -- polyethylene, N -- nylon, R -- Rockhide (PVC)



For general illumination, The Scott fixture by Sylvania provides soft, even light, has extremely high, 89.8%, illumination efficiency—giving a bonus in performance at no additional cost.



For close-work areas, mounting The Scott parallel to workers' line of vision brings maximum lengthwise shielding benefit into play. Lightweight plastic louver combines outstanding appearance with installation and maintenance features.

Supplementary lighting no longer needed...

Sylvania's Scott Fixture now provides precision lighting at Bendix Aviation

ENGINEERS WORKED OUT an unusual and successful lighting approach at the Eclipse Pioneer Division of Bendix Aviation Corp., Teterboro, New Jersey. In a semi-industrial area, they used a commercial-type fixture... Sylvania's *Scott*... to provide general illumination for precision motor assembly work.

Here The Scott does a double lighting job by eliminating the supplementary lighting system used previously:

1. The *Scott*, with its all-plastic reflector-shield, gives Bendix 110-116 footcandles of light at working level. It holds shadows and glares to a minimum, makes difficult seeing tasks easier.

2. The *Scott's* clean, attractive appearance harmonizes with the modern interior. Bendix personnel proudly show the installation to visitors as one more way Bendix protects the quality of its products.

Sylvania's *Scott* fixture offers many economies in both industrial and commercial applications. Because it has an exceptionally high, 89.8%, efficiency, *The Scott* will, in many cases, give the desired illumination levels with fewer fixtures—along with quality lighting.

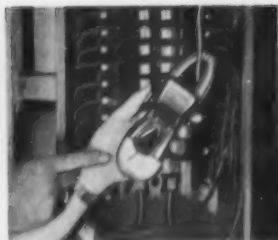
Next time you have an illumination problem either in industrial or commercial "close-work" areas, investigate the many

advantages of lighting with Sylvania's *Scott*. For complete information, contact your local Sylvania Lighting Specialist, or write directly to:

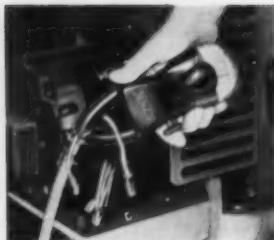
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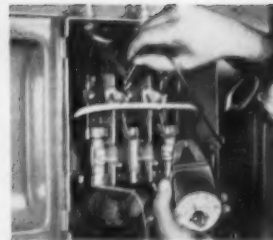
Show need for additional service



Take current readings without shutdowns



Check appliance current at plug



Instantly determine if fuses are good



Know if load is balanced

13 different jobs that call for an AMPROBE



Determine hot e_1 of receptacle



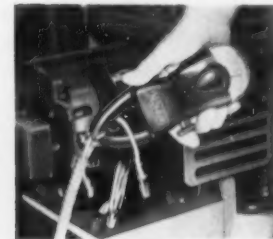
Check capacity of motor capacitors



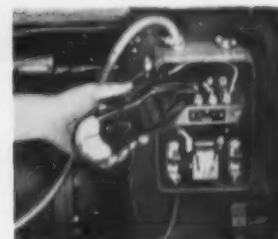
Use for periodic motor checks



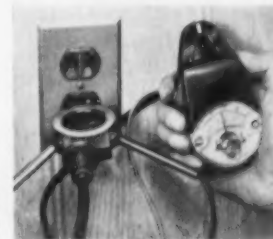
Know if windings are grounded



Determine motor overloading



Trouble shoot relays quickly



Check appliance voltage at receptacle



Use for lighting circuit surveys

Don't guess at it. *Amprobe it.*

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Amprobe is a division of Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, New York, manufacturer of REMCON simplified low-voltage switching devices.

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BullDog Bus Plugs for Plug-In Duct meet a full range of applications, perform with top efficiency and safety. Seven plugs are available—from types which tap power instantly from the duct to types which provide constant safety checks on its operation.

The seven BullDog Plugs—BP, Vacu-Break®, Circuit-Breaker, Capacitor, Transformer, Ground Detector, and Temperature Indicating—are all safety engineered.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . DECEMBER, 1956

61



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Fewer New Homes

Government authorities expect a small increase in total building next year, about 5%, with some ups and downs in particular categories. Residential building, however, which will total 1,100,000 units this year, off 200,000 from 1955, may drop below the 1,000,000 mark in 1957.

In dollars the forecast for residential construction is less somber. The predicted decline is only 3% for 1957 which indicates that fewer homes will be built, but they will average higher in value. And there is little question that much of the current and prospective decline in new housing is the result of anti-inflation, "tight money" policies.

For electrical work, the small declines in residential construction predicted are not alarming. Under the forces of consumer promotion on adequate wiring and advancing electrical utilization in the home, the electric "package" per housing unit is growing steadily and there is still plenty of potential to develop.

Fewer housing units in prospect also suggests that the new homes of next year may be more distinctive and more likely to be exemplary of modern living standards and tastes. It will be more important than ever, therefore, that every new home receive the best electrical planning that the industry can provide.

Fortunately, the industry has, in these times, an unprecedented supply of excellent educational, technical and sales aids. Adequate Wiring Bureaus and the "Live Better Electrically" and "Housepower" programs can provide authoritative help for the consumer, the builder, the contractor and the architect. The technology of good wiring design practice has also been set forth ably in the leading shelter and building trade publications. The benefits of electrical living are well known. The importance of adequate wiring is also better known to the public than ever before.

What must be watched is the competitive position of the electrical industry. Fewer housing units will bring sharper competition for key equipments, like cooking, laundry, water heating and air conditioning. And any success of competitive "fuels" in these fields could materially affect electrical prospects, not only for electrically energized appliances and equipment, but for wiring installations and kilowatt-hour sales.

With sound selling, the fewer new homes of 1957 could still produce a substantial net increase in electrical work. The market has been and will continue to be well prepared for better electrification. The trend toward larger homes with more quality features will grow. It is up to all of us to see to it that these quality features include the best of electric wiring and equipment.

Wm. T. Stuart



Power distribution systems that can effectively handle future demands are the surest way to avoid latter-day costs. Local Graybar Repre-

sentatives will work with you and your customers in the selection of wiring and equipment to meet today's needs . . . and tomorrow's.

POWER DISTRIBUTION

proper planning saves future costs

Your customer is building a new plant or planning to expand present facilities. You want to install an electrical system that will satisfy today's needs yet provide the greatest flexibility for future growth. Calling Graybar is the easiest way to avoid electrical obsolescence, costly rewiring, and plant engineering problems at a later date.

A Graybar Inside Construction Specialist will review the requirements with you and your customer. From broad experience he can suggest new methods and recommend modern wiring techniques. He can advise in the selection of the latest products available and help determine a power-distribution system that will serve present, near-future and long-range expansion demands.

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On the job at Picatinny Arsenal:

POLE-LINE DISTRIBUTION



A close look at pole-line work and substation installations in the expansion and modernization of power generating and high-voltage distribution facilities over the 6,000 acres of the nation's leading ammunition research and development center at Dover, N. J.

By Robert B. Berger *President, B. B. Electrical Contractors, Inc., Paterson, N. J.*

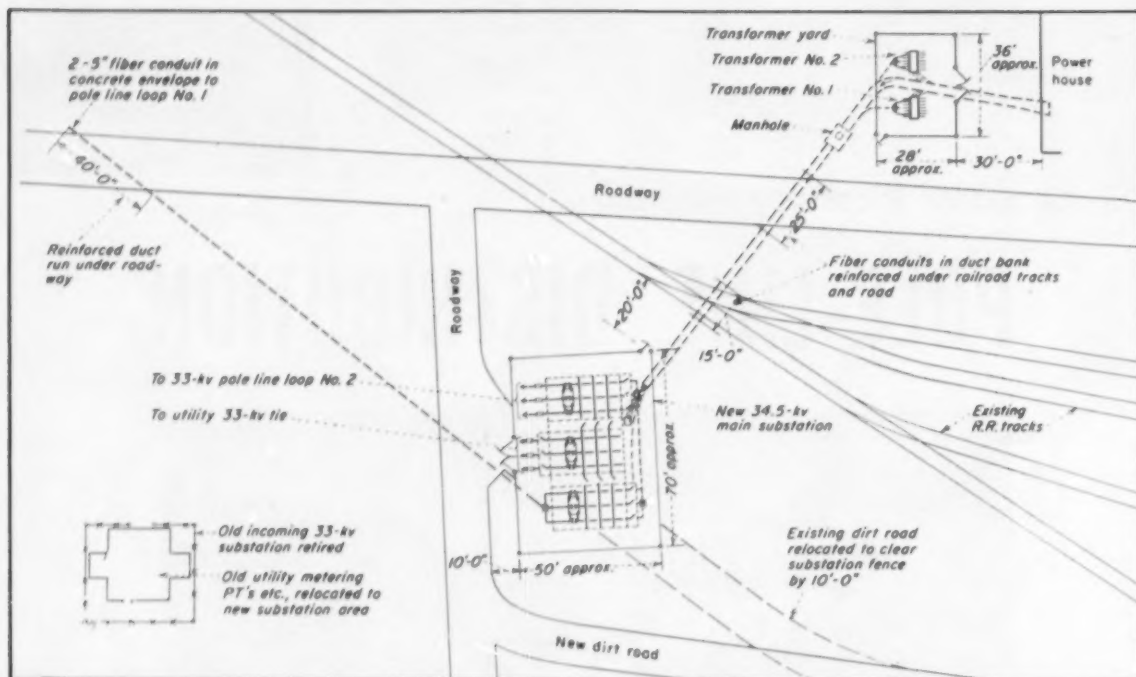
EXPANSION of the electrical system serving the widespread Picatinny Arsenal at Dover, N. J., involved just about every conceivable type of electrical construction. But the major phase of the project consisted of construction of a vast network of interconnected high-voltage substations, pole-line feeders and underground runs. A close look at this work reveals the wealth of wiring and construction methods involved in typical pole-line work and heavy outdoor construction.

Prior to the new installation,

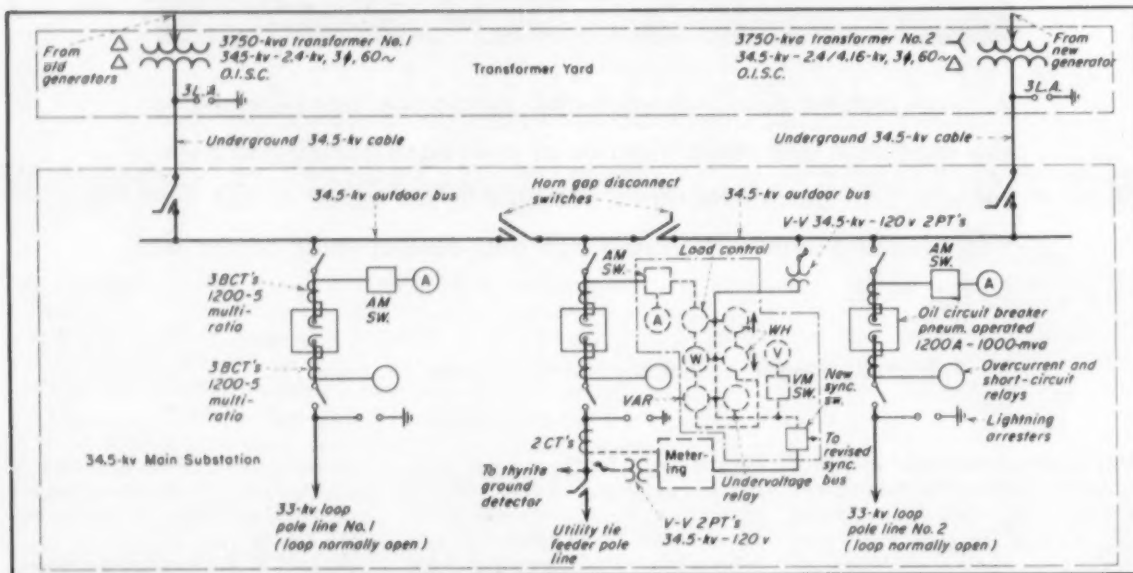
electric power for the arsenal facilities was developed by four 2400-volt generators in the arsenal's own power house. These generators provided a total rated capacity of 5,850 kilowatts. And in addition to the generators, a utility power line was tied into the arsenal system for exchange of power with the utility. This incoming utility line was a 34.5-kv feeder, delivered to a 3000-kva substation on the arsenal property where the voltage level was stepped to 2400 volts for connection into the arsenal's 2400-volt pole-line distribution system. The existing

pole-line system was a 2400-volt radial system with provision for interconnecting feeders at several remote points.

As part of the expansion project, a new 3750-kva generator was installed in the power house, and the existing system of 2400-volt feeders and the interconnection to the utility were modified and integrated in a new overall system of 34.5-kv pole-line feeders forming a primary distribution system. This primary line was carried in a loop to four unit substations strategically located throughout the arsenal area



FOCAL POINT of modernized system is area around power house. Feeders from generators in power house come out underground to transformer yard, then run underground to main substation at which primary loop originates and utility line comes in. Plot plan shows relative locations of power house, transformer yard and main sub.



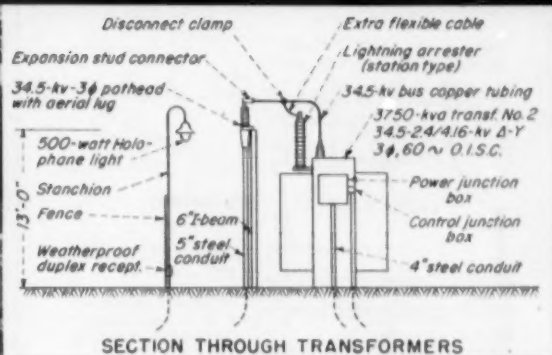
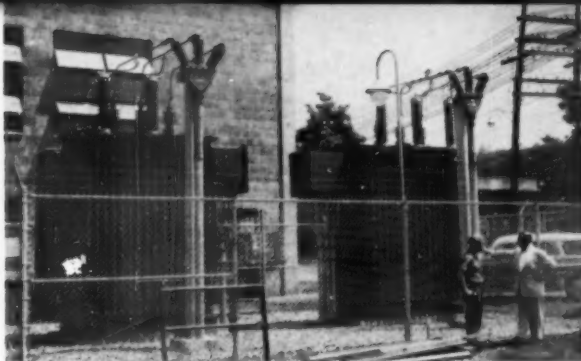
ONE-LINE DIAGRAM shows electrical circuiting of transformer yard and main substation.

and widely spaced from each other and from the power house. These substations are tied into the 2400-volt distribution system on their secondary sides. New main substation facilities and switching and control equipment were installed to provide interconnection among the

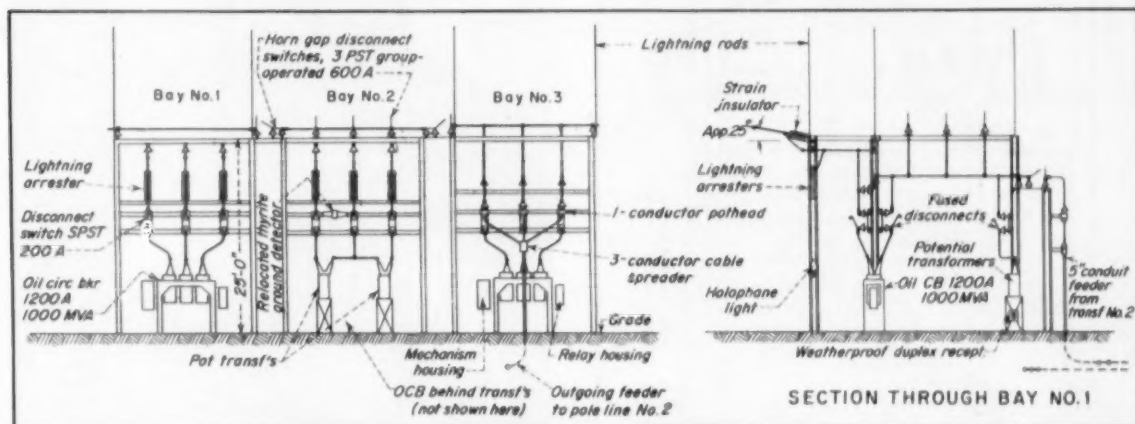
2400-volt power house generators, the 34.5-kv incoming utility line and the 34.5-kv distribution loop.

The focal point of the overall modernization job was the arsenal power house and its wiring. Installation of the new generator included all of the necessary switchgear and

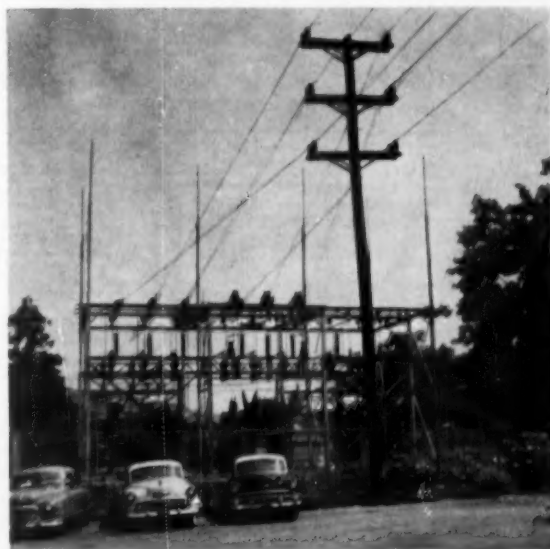
control panels and equipment, including protective devices. Extensive additions were also made on the distribution system for light and power in the power house. This load included a wide variety of 2400-volt and 440-volt motors for boiler and steam system equipment. The new



TRANSFORMER YARD is located adjacent to power house. Transformers are oil-immersed, self-cooled—of sealed tank construction, equipped with tap changers in high-voltage windings for de-energized operation. In right background of photo, old 2400-volt feeders from the power house are shown on 2-pole structure.



MAIN SUBSTATION is fed underground from transformer yard and supplies one short run of outgoing underground feeder to a nearby pole structure at which one end of primary loop begins. All underground feeders are 3/c, 3/0, compact round, 34.5 kv, paper-insulated lead-covered, shielded copper cable. Incoming overhead utility feeder and outgoing overhead feeder to other side of primary loop are 1/0 ACSR. Two-circuit, double-arm pole in foreground supports incoming utility feeder conductors on three crossarm ends on right side of pole and outgoing primary loop feeder on left side of pole. Grounding system for sub consists of a 250 MCM bare stranded copper ground bus installed below grade around periphery of substation just inside fence. Sides and end of ground loop are connected together to form a grid under substation. All connections are welded. Ground risers are 250 MCM, stranded, to arresters and other equipment, and 2/0 to structure steel.

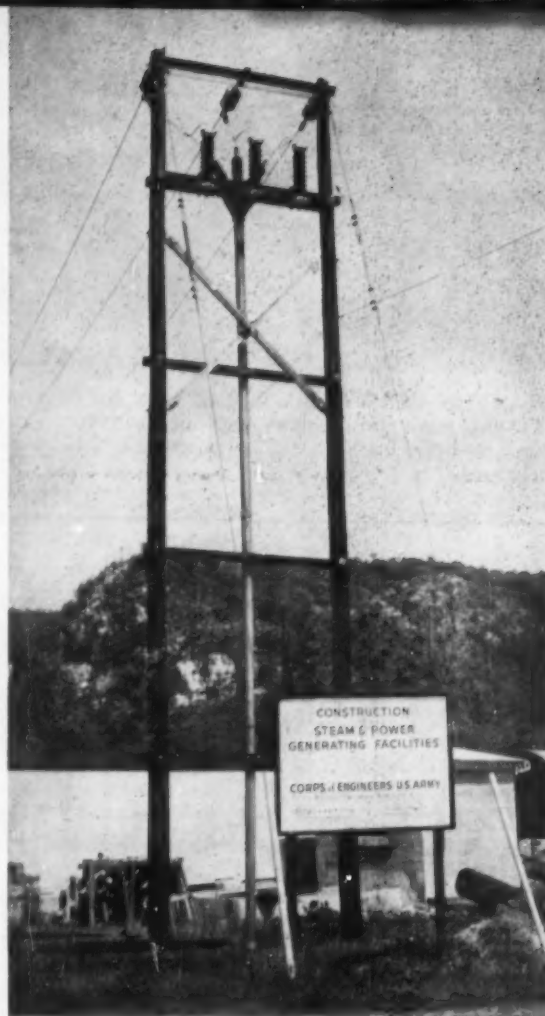
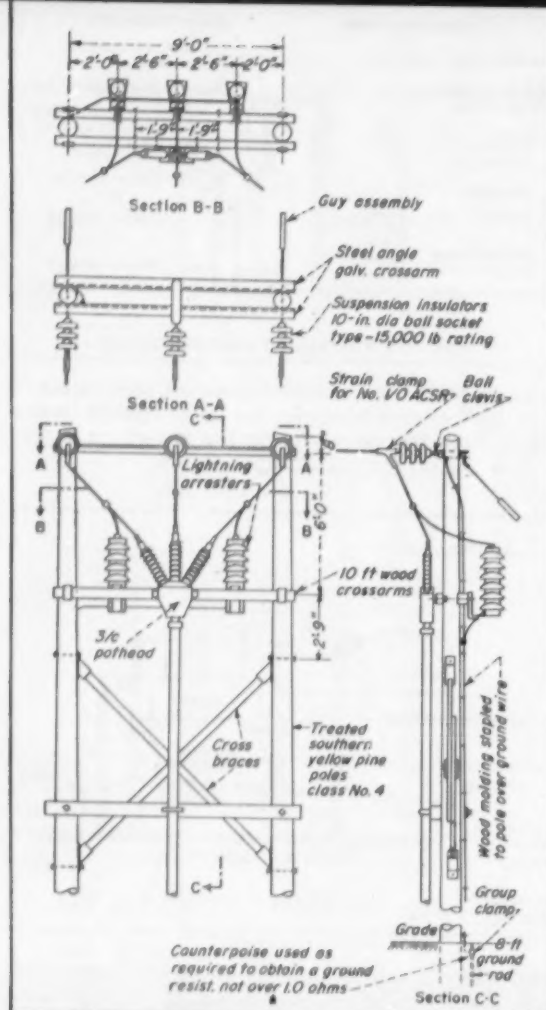


and existing equipment in the power house is supplied either directly from the 2400-volt generator bus or through transformers supplied from the bus. This generator bus is supplied by existing generators only. Most of the existing 2400-volt feeders from the old generator bus were

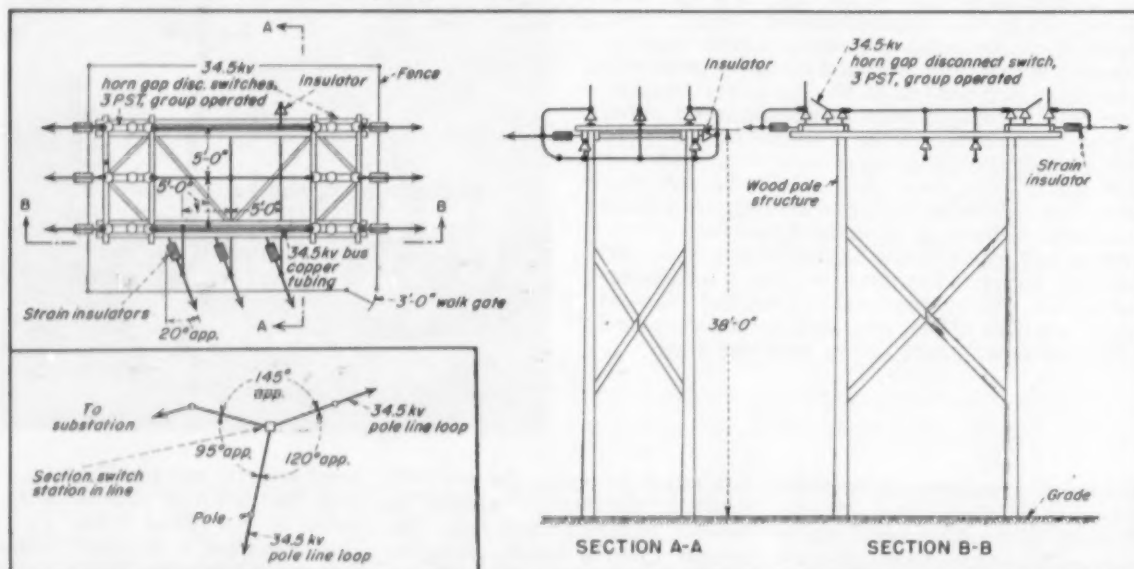
left intact supplying the 2400-volt pole-line distribution system to various buildings throughout the arsenal. Circuits removed from the bus were connected to the outlying substations.

In the old layout, a 34.5-kv utility pole-line feeder came into the ar-

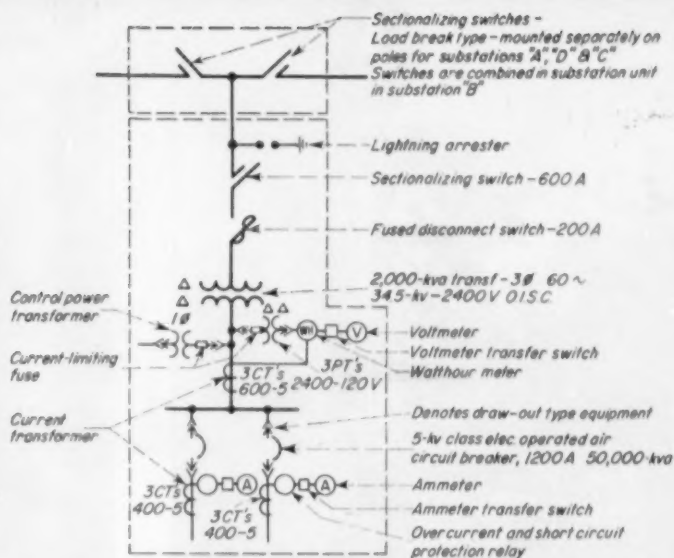
senal property and supplied an outdoor 34.5-to-2.4-kv substation adjacent to the power house. From this substation, a 2400-volt feeder was carried into the power house and connected to the 2400-volt generator bus. In the new system, the outdoor sub fed by the utility was



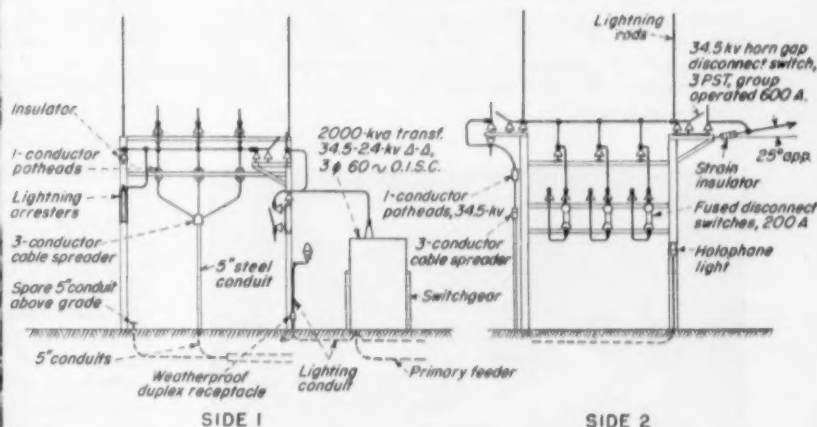
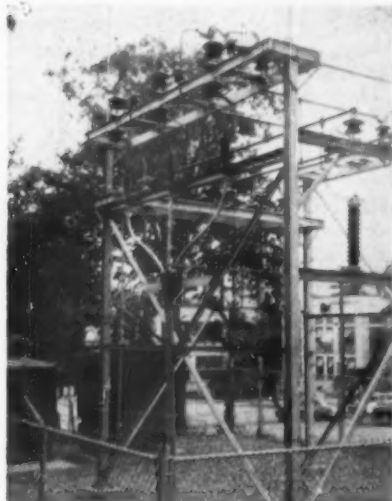
TRANSITION POLE near main substation is supplied underground from 34.5-kv outdoor bus in sub. Primary pole-line loop makes outgoing run from this pole.



SECTIONALIZING SWITCHES are installed in primary loop at points of tap to load-center substations. Diagram at lower left shows position of typical sectionalizing switch station in line. Station has two 3-pole, single-throw, group-operated, horn-gap disconnecting switches which serve to sectionalize the line. Line tap to load-center sub is made between disconnects, and no disconnect is used with tap.



TYPICAL SUBSTATION supplied by tap from primary loop is shown here. Tap feeders run from sectionalizing switch station (about 100 yards to left in photo) to dead-end pole with angle-iron crossarms (shown). Electrical arrangement of substation (right) is typical of all load subs in the system. These subs feed 2400-volt distribution feeders previously supplied directly from old generators in power house.



PRIMARY FEED-THROUGH is made in one substation using sectionalizing switches integral with the substation structure, instead of a separate sectionalizing switch station. Primary line comes in overhead and goes out underground, as shown. Taps to primary bus are made between switches.

abandoned, and the connection to the generator bus was removed. Interconnection between the arsenal power system and the utility system is now made at 34.5 kv in a new outdoor main substation, as follows:

1. Two sets of feeders are brought out of the power house, underground to a main transformer yard immediately adjacent to the power house. One of these feeders comes from the generator bus fed by the old generators; the other comes from the new generator.

2. Each of the feeders is brought

up to a 3750-kva, oil-immersed, self-cooled, 3-phase outdoor type transformer. Transformer No. 1 is fed from the old generator bus and is connected 2400-volt delta stepped up to 34.5 kv delta. The old generators are 2400-volt wye connected. Transformer No. 2 is fed from the new generator which is 4160-volt wye, 2400-volt phase-to-neutral. This transformer is connected 4160-volt wye stepped up to 34.5 kv delta.

3. From the high-voltage side of each transformer, an underground feeder is carried to a nearby main

substation where the two underground feeders are paralleled on the 34.5-kv outdoor bus. The 34.5-kv utility pole-line feeder comes into this same bus.

Details of typical phases of the work and installation methods and techniques are shown in the accompanying illustrations. Engineering of the complete arsenal electrical system was done by Burns and Roe, Inc., Architects and Engineers, New York, N. Y., and the Corps of Engineers, U. S. Army, New York District, New York, N. Y.



TYPICAL LINE CREWS worked from full-body line trucks as shown here. Linemen are shown installing transformers on a 2400-volt distribution feeder to provide 120/240-volt, three-wire, single-phase feeder circuits to nearby buildings for lighting and small motor loads. Although the 2400-volt line was not "hot" here, the truck and crew are equipped for such work. Truck contains all necessary tools and supplies and has a 10-ton winch and 7-ton boom.



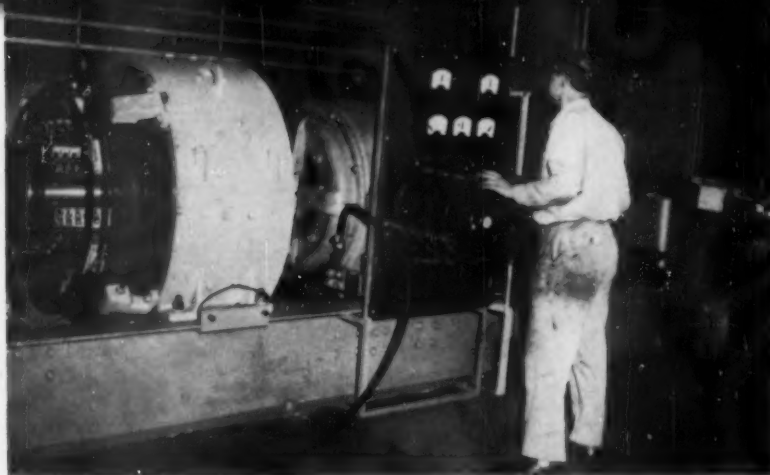
RIGHT-OF-WAY clearance must be made for running a pole-line through forests. Here is a typical right-of-way undergoing clearance. Telephone line is shown. New 34.5-kv line will be run through at right of poles shown. High tension lines are kept in relatively out-of-the-way places to avoid any hazards due to broken lines. Clearance of right-of-way follows a general pattern. First, underbrush is cleared away to permit access for equipment and trucks. Then big tree limbs are cut down to increase working space. Next, trees are cut for width of right-of-way. Trees are then cut up and hauled away or burned; and stumps are blasted out or pulled out. Finally, a road is graded to allow entry and operation of line erection trucks and to provide access for later maintenance of the line.



HOLE-DIGGING was done with combination hydraulic earth-boring machines with pole-setters for setting poles up to 50-ft. high. Hole digger has 180-degree swivel and extends up to 24 inches for accurate positioning of pole holes. Digger shown here can dig holes up to 60 inches in diameter. And equipped with an 18-foot arbor bar, it can dig holes up to 11 feet deep for setting poles up to 110 feet long.

TYPICAL CONDITION encountered in setting poles throughout mountainous areas is shown here. This pole is set in solid rock. A hole 7-feet deep was blown with 40 sticks of 60% dynamite. To blow such a hole, carbide drills were used with air compressors. First, 18-inch holes were drilled—one such hole at the position of the pole and one each at guy anchor positions. A stick of dynamite was then set off in each hole. After the blasts, each hole was cleaned out. Then the procedure was repeated until required hole depths were obtained. Holes did not have to be as deep in rock as in other places.





TEST RUN on one of 84 dc generators rebuilt by Marine Electric Corp. to provide 25% additional output and longer life. A 200-hp motor at center drives unit under test while a second generator behind control board supplies a load.

Rebuilding Rotating Machines

The demand for higher output and longer life in power equipment offers broad opportunities for motor shops. A practical analysis of this market and pointers derived from rebuilding 80 400-kw generators.

By **Harry G. Parke**, *Chief Engineer, Marine Electric Corp., Brooklyn, N. Y.*

THE present high productivity of American industry has been achieved, to a large degree, by development of highly efficient machines and intricate production-line systems. Yet these technical advances in our manufacturing methods have not been obtained without creating new problems and aggravating older ones.

Electrical load growth has, of course, become a critical problem to managements of highly mechanized plants. Distribution systems have had to be revised and expanded to afford the greater capacity and flexibility of control and operation required by constantly shifting, ever increasing load patterns. A less publicized aspect of this situation, but one offering tremendous potential to the electrical service industry, is the need for higher mechanical power output from the electrical motors that drive the production machines.

This need for more power has come about in several ways. In many cases, existing equipment is called upon to process tougher,

harder materials; in others, new models of machines demand increased power in order to perform at their full efficiency. Many other causes derive from special conditions in specific processes involved.

Whenever new power requirements do not involve drastic changes in operating characteristics of the rotary driving equipment, it is very often possible to rebuild existing apparatus to obtain the additional power needed. This can usually be accomplished at less cost than replacement of motors.

The Maintenance Problem

A second consideration that gains critical importance in today's highly mechanized industrial plant is the necessity of maintaining uninterrupted operation of equipment during work periods.

Several factors contribute to this condition:

1. The assembly line method of production generally used in modern plants has so carefully inte-

grated the flow of processed materials from one stage of production to the next, that the breakdown of a single machine can retard or even stop operation of the entire plant in a short period of time.

2. Constant improvements in the design of both product and machine result in rapid obsolescence of production equipment. Volume must therefore be kept at a maximum to amortize the cost of machines as quickly as possible.

3. High fixed costs, particularly productive and non-productive labor, require large product output to keep cost-per-unit to a minimum.

The need for continuity of equipment operation led manufacturers to establish well-staffed maintenance departments, equipped to repair or replace defective system components in a minimum of time. As each minute of shutdown time became more costly, programs of preventive maintenance were set up to check critical equipment, lubricate machinery and replace worn parts before failures could



FIELD COILS are wound on shop-built form designed to fit original iron pole pieces. Careful calculations and experimentation were required to balance effects of shunt and series fields within limits of operating specifications.



FIELD CONNECTIONS of copper bar stock are individually fitted after pole pieces and field coils have been mounted in stator. Cutting and bending bench is placed nearby to reduce waste time in making fine adjustments to connecting straps.

occur. Today, however, another approach to the problem is receiving the attention of alert industrial men. This is the development and application of techniques for employing new materials which will give longer life, more reliable performance to production equipment.

The Market for Rebuilding

Knowing the vast new business potential that is created by this need for more power and greater reliability from rotating electrical equipment, how can the motor shop begin to develop this market?

Some practical and technical clues can be found in the history of a recent project undertaken at Marine Electric Corp., Brooklyn, N. Y., for the Military Sea Transport Service section of the U. S. Navy. Although this particular project involved marine equipment, the case is applicable, since the problems of increased demand and reliable service were encountered. In fact, reliability of power equipment is even more critical on shipboard since the ship might be weeks away from a repair yard at the time of a breakdown.

In the contract under discussion, the work consisted of rebuilding 84 400-kw generators, a sizable project.

Performance specifications were established by the Navy's engineers, but the entire redesigning job was

included in the contract for rebuilding the machines. A high degree of engineering skill was mandatory because of the absolute necessity for trouble-free operation of the rebuilt equipment.

Design Considerations

Original power plants for each C-4 transport ship consisted of three Crocker-Wheeler 400-kw two-wire turbine-driven generators delivering current at 250 volts dc. Three 150-kw motor-generator sets were operated off the main plants to obtain 115 vdc for lighting.

Steady growth of demand required that capacity of the primary plant be raised to 1500 kw, or 500 kw per generator. It was further determined to eliminate the losses occurring in the three 150-kw motor-generators by converting the primary units to 3-wire 240/120-volt operation and supplying lighting loads directly from them.

One of the first problems encountered in redesigning the generators was the determination of the type of insulation to be used. Performance specifications called for replacing the original Class A insulation with Class B. But we had to double check this provision since we, as contractors, would be held responsible for successful performance of the rebuilt equipment.

No accurate temperature rise data on these generators was avail-

able at this time, so we had to work on the assumption the temperature rise in the existing plants was already up to 65° C, the maximum allowed for Class A insulation. Similarly, it was not known if iron clearances would permit a substantial increase in copper cross section, so the initial resistance factor had to be used in calculating possible increase in hot-spot temperature rise.

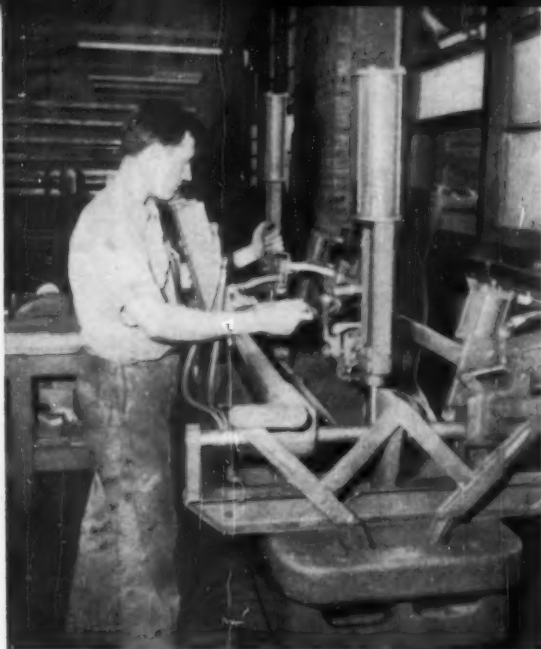
Losses at the hottest spot of the insulation are, in general, roughly proportional square of the load current. Therefore, if current was to be boosted by 25%, the increase in hot-spot temperature would be: $(1.25)^2 - (1.00)^2 = .5625$ or 56%.

If the preceding conditions applied, the temperature rise at the hottest spot would then be:

$$1.56 \times 65^\circ \text{C} = 101.4^\circ \text{C}.$$

This exceeded the 90° C rise permitted for the specified Class B insulations. Though the likelihood of these conditions occurring was considered remote, it was decided to employ Class H insulation, which allows a 140° C rise. At the subsequent completion of tests and measurements it was found that Class B temperature limits are nowhere exceeded, but the silicone insulation should provide an ample margin of overload capacity plus resistance to hard use and a long usable life.

Since temperatures did not reach Class H levels, some minor devia-



NEW ARMATURE COILS are shaped on forming machine. Precise engineering and meticulous workmanship are essential in rebuilding equipment to ensure lengthy trouble-free service. Only original yoke and pole pieces remained.



NEW ARMATURE is stood on end during baking so drippings will not form uneven surface. Coils and armature received three vacuum impregnations of silicone varnish and a finish coat of black Silkyd 1400 varnish for added oil resistance.

tions were made from Class H insulation. Instead of silicone glass laminate, a polyester glass mat laminate was used for mechanical purposes. This change was made because of the easier machinability, lower cost, and excellent mechanical and arc quenching properties of the polyester. Silicone glass laminate was used, however, wherever it acted directly as electrical insulation. The other modification was to finish off all windings with one coat of Dow Corning Silkyd 1400 black varnish to improve appearance and to provide superior oil resistance. Windings had previously received three vacuum impregnations of Dow Corning No. 977 silicone varnish.

Field Design

Precise balancing of shunt and series fields was a critical factor in this design. The increased output of the generators necessitated strong saturation of the iron at full output. This aggravated the variation in the permeability of the magnetic circuit between full and low load conditions. Furthermore it reduced the effect of a given number of series field ampere turns at higher loads. Thus, if we attempted to use enough series field to prevent voltage drop at full load, we would get a sharp voltage rise at low load. This would preclude parallel operation of units

without an equalizer connection, a requisite of design.

Preliminary to rebuilding, it was necessary to accurately determine the characteristics of the magnetic structure of the machines. Two original units were obtained for this purpose from C-4 transport ships in the mothball fleet. These were mounted on a common shaft with a 200-hp drive motor. One generator was used to load the other and saturation and load curves were taken.

From these data we were able to calculate the allowable series field within the foregoing restrictions. These findings were checked experimentally by diverting various amounts of current around the series field with a manganin shunt and taking meter readings.

From these investigations it was found possible to just meet all requirements by reducing the series field from two turns to half a turn (shunted), and by increasing the shunt fields to fill the additional wiring space available. In order to obtain some extent of compensation for the increased saturation in the iron at the higher power outputs the machines would now be delivering, interpole windings were increased from $4\frac{1}{2}$ to $4\frac{1}{4}$ turns per pole.

Careful consideration was given to the capacity of the commutators for the rebuilt generators, as this is often a limiting factor in uprat-

ing dc machines. The original commutator operated at a brush density of 53 amps per square inch and a surface speed of 5300 ft per minute. Increasing the load current by 25% meant that one of three changes would be required:

1. Increase commutator diameter and surface speed,
2. Increase brush width, or
3. Increase current density of brushes.

Since commutator speed was already rather high, this course was eliminated. It was then decided to reject the second course, too, since increasing brush width often leads to poor commutation. The third possibility was adopted, as it was concluded that modern brush materials could capably handle the required density of 67 amp/sq in.

To obtain the third wire for the new 120/240-volt output, two slip rings were cast in bronze. Each was 17-in. in diameter by 1-in. thick and connected to the windings at points 180° apart.

Because of the magnitude of the job it was thought well to supplement our engineering staff with an outside consultant. Professor Guiseppe Calabrese of New York University's Electrical Engineering Department was engaged. His advice was extremely helpful, but his approval of our designs and calculations was considered even more invaluable because of the responsibilities entailed.

New Concept of

CONCEALED BUS DUCT SERVICE

combines economy and trim physical appearance with electrical flexibility and safety at Village Shopping Center in Gary, Ind. Six duct runs serve four to six stores each.

The electrical installation described in this article represents a new concept of a totally enclosed bus duct service entrance facility serving several groups of service equipment (individual stores). Compliance with existing Code regulations might be questioned. Before the installation was started, the complete design was carefully studied by three independent inspection agencies having jurisdiction. Approval was granted by the Indiana State Fire Marshal's office, the City of Gary Electrical Department, and officials of the Northern Indiana Public Service Company.

—The Editor

WHEN plans for the Village Shopping Center in Gary, Ind., were being drawn, Sweney Electric Company, Inc., was assigned the highly interesting task of designing and installing a complete electrical system for the giant L-shaped structure. The problem was that of providing adequate service capacity and distribution facilities for 192,000 sq ft of sales area which eventually was divided into 35 separate stores. In addition to electrical capacity, service flexibility and overall economy were prime considerations.

The project owner wanted to keep the exterior of the structure trim as possible. This ruled out primary pole-line distribution and numerous

secondary service drops to the group of stores. Not only would this have been unsightly, but it would have reduced available parking space due to the easement rights of the utility company. The overall object of the final design was to conceal electrical service facilities as much as possible; also to make it easy and economical to change individual store services when necessary.

From experience, the basic design figure of 5 watts per sq ft was used for lighting requirements and 2 watts per sq ft for all air-conditioning, heating and miscellaneous motor loads. The system was designed to handle approximately 1,344 kw of load, at an 85% demand for a

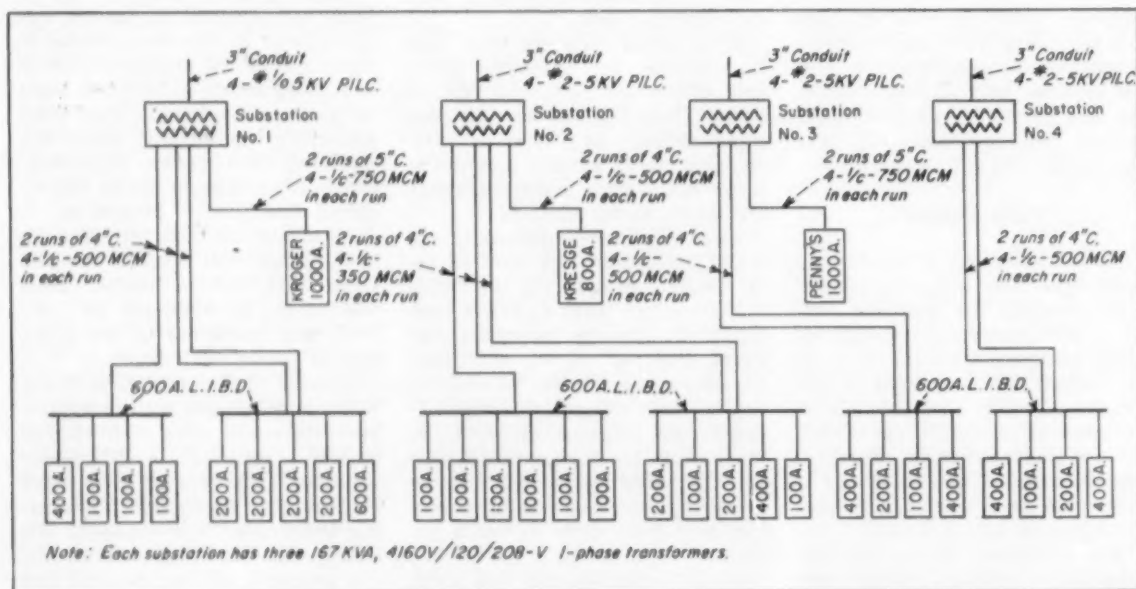


FIG. 1—ONE LINE DIAGRAM showing general pattern of shopping center electrical service. Note grouping of stores into approximately 600-amp secondary service increments. Underground feeders from each substation terminate at runs of 600-amp, 3-phase, 4-wire "service entrance bus duct" which, in turn, serve from four to six stores each.

ENTRANCE

By Robert E. Walton

Vice President
Sweeney Electric Company, Inc.,
Electrical Contractors and Engineers
Gary, Ind.

connected running load of 1,142 kilowatts. Anticipating the electrical demands of the 35 individual stores (28 originally) rapidly became an art instead of a science.

Underground Feeders

Primary service to the project originates at the 4,160-volt, 4-wire, 3-phase transmission lines of the Northern Indiana Public Service Company. Primary feeders from the utility poles are installed underground (4-conductor, No. 2, PILC cable in 3-in. duct) to four ground-level substations located in the parking areas at the rear of the building. Possible future expansion is taken care of by a spare 3-in. duct in the same trench.

Each of the four substations contains three 167-kva, single-phase transformers. Secondary voltage for shopping center service is at 130/208 volts, 3-phase, 4-wire. Protective redwood fencing around each substation blends with the architectural features of the center.

Bus Duct Service Pattern

The entire sales area of the center was laid out on a general pattern for electrical service. Basically, this involved combining individual stores into groups approximating 600-amp service increments (see Fig. 1). Secondary service to such a group is provided by a run of concealed, 600-amp, 3-phase, 4-wire Westinghouse aluminum bus duct. Services requirements of individual stores are as follows:

No. of Stores	Size of Service	Type of Service
2	1,000 amps each	Separate
1	800 amps each	Separate
1	600 amps each	Grouped on Bus Duct

Labor Units — Bus Duct Installation									
Bus Duct Size		Labor Units — Man Hours							
Rating Ampere	Wt. per Foot	Duct per Foot	Elbows — Each	Cross — Each	End Caps — Each	Cable Box — Each	Flanged End — Each	Expansion Joint — Each	Tee
Plug In Duct 2-Pole 575 Volts or Less									
250	5.5#	.18	1.25	2.5	.3	1.5	.7	2.6	1.8
400	6.5#	.20	1.50	3.0	.3	1.75	.9	2.95	2.05
600	8.3#	.25	1.75	3.5	.3	2.0	1.1	3.5	2.30
Plug In Duct 3-Pole 575 Volts or Less									
250	5.8#	.21	1.6	3.2	.3	1.75	1.0	3.0	2.1
400	7.3#	.23	1.85	3.7	.3	2.0	1.2	3.25	2.35
600	9.5#	.30	2.10	4.2	.3	2.25	1.3	3.5	2.6
Plug In Duct 3-Phase, 4W 480 Volts or Less									
250	6.3#	.24	2.0	4.0	.3	2.0	1.25	3.5	2.5
400	8.0#	.26	2.25	4.5	.3	2.25	1.45	3.75	2.75
600	10.3#	.35	2.50	5.00	.3	2.5	1.65	4.0	3.00
Hangers for Duct									
Ceiling Height		Wood — each		Concrete — each		Steel — each			
10-12		1.25		1.75		2.00			
13-15		1.40		1.95		2.20			
16-18		1.65		2.30		2.60			
NOTE:									
Duct is all estimated straight run. If offsets are used, use units per foot plus 25%. Duct unit covers mounting duct in hangers & bolting bus together.									
Elbow includes mounting elbows in hangers & bolting bus together.									
Tee includes mounting tee in hanger & bolting bus together.									
Cross includes mounting cross in hanger & bolting bus together.									
Cable Box includes fastening box at duct joint. It does not include conduit terminals, lugs, etc.									
Flanged End includes mounting flanged end in hanger and bolting bus together. It does not include fastening the flange to switchboard, etc.									
Expansion Joint includes mounting in hangers & bolting bus together.									
End Caps includes bolting end cap to end of duct run.									
Hangers include fabrication, measuring, mounting, and fastening of either rod type or strap iron hangers. Allow one for each 5' of duct & one additional at each accessory. Included in all units is labor for reasonable delivery & distribution of materials. Any unusual conditions should be estimated as a separate labor item.									

6	400 amps each	Grouped on Bus Duct
8	200 amps each	Grouped on Bus Duct
17	100 amps each	Grouped on Bus Duct

A total of six runs of 600-amp bus duct (approximating a total of 600 ft) constitutes the service facilities for all but the three largest stores. The two 1,000-amp and one 800-amp services are fed underground direct from their respective substations.

Each run of bus duct, serving from four to six individual stores, is installed in the crawl space between the suspended acoustical tile ceilings and the metal pan roof deck. Each duct run is fed underground by two or four parallel lines of 4-in. conduit originating at a substation and terminating in a center-tap box at ceiling height. In general, duct

lines with 4-conduit feeds are split in the center and serve groups of stores whose total connected running loads are in excess of the 600-amp increments. Each feeder conduit contains four 500MCM, neoprene-jacketed cables. No fused protection is provided between the primary side of each transformer and the first thermal breaker in each store.

A spare 4-in. conduit from the substation to building floor line parallels each bus duct secondary feeder and provides for possible future expansion.

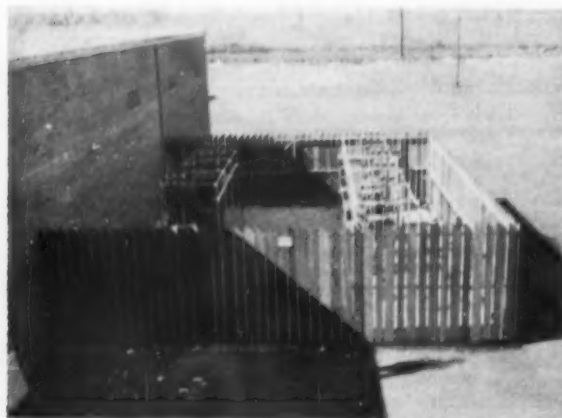
There were a number of reasons for choosing the 600-amp size duct. Engineering analysis and study proved that the 600-amp, 3-phase, 4-wire, low-impedance aluminum bus duct would be less expensive installed than conduit and wire. The aluminum conductor was selected



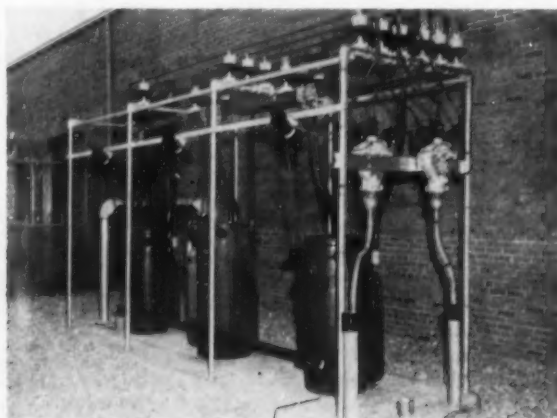
VILLAGE SHOPPING CENTER in Gary, Ind., is a giant L-shaped structure housing 35 individual stores. Underground electrical distribution and indoor concealed service entrance bus duct facilities eliminate spider web of service drops and maze of conduit and cable.



STUDYING DETAILS of new concept of bus duct service entrance for the shopping center are: (L to R) H. W. Van Stee, district inspector; H. C. Hawkins, district engineering supervisor; P. J. Bosse, district engineer—all of Northern Indiana Public Service Co., Gary; and electrical contractor R. E. Walton, vice president, Sweeney Electric Co., Inc., Gary.



LARGEST OF SUBSTATIONS, the only exterior evidence of electrical system, is this dual unit. Bank of transformers on left provides 120/208-volt service to stores; bank on right is for entire parking area lighting.



TYPICAL TRANSFORMER MAT in outdoor substation. In general, transformers are 167-kva, 4160-volt primary, 120/208-volt secondary. Underground primary feeders are in foreground, secondary feeders are grouped in background.

because of economy. Although a larger cross-sectional area of aluminum bar (compared to copper) was necessary, the overall weight of duct sections was still kept reasonable because of the weight differential between the two conducting metals.

Low-impedance duct was selected to keep voltage drop to a minimum and eliminate, as much as possible, interference to fluorescent and slim-line lighting due to the starting surges of several large motors.

Labor units applicable to bus duct installation are listed in the accompanying chart.

Individual Service Taps

Although the runs of bus duct are completely concealed above the suspended ceilings at the rear of the building, access for individual

service taps are provided in each store. Fairly deep, rectangular, tap boxes, mounted to the duct at predetermined locations, extend well below the finished ceiling line. They contain bus bar extensions equipped with solderless cable connectors and have split screw-covers. One cover section accommodates the conduit service drop; the other provides access for cable connections.

Thus, individual service tap for each store is obtained by merely installing a length of conduit (with necessary cables) from the current-transformer cabinet or main distribution panel, up the wall to the duct cable-tap box. Any future changes in individual store services will involve only a change of this conduit drop—all work being from the tap box out. The bus duct service entrance run remains intact in the ceiling plenum space.

Special Approval Granted

This installation involved an entirely new concept of service entrance—the use of totally concealed bus duct service. Special permission of local and state inspection authorities was sought and granted when the design was made.

While the regulations of the National Electrical Code appeared somewhat vague concerning bus duct installation for secondary services, the following factors of the proposed design were emphasized:

The building is of fireproof construction with firewalls between stores.

The bus duct is concealed in the roof truss crawl space between a suspended plaster and acoustical tile ceiling and metal roof deck.

Each individual store has access to this crawl space.

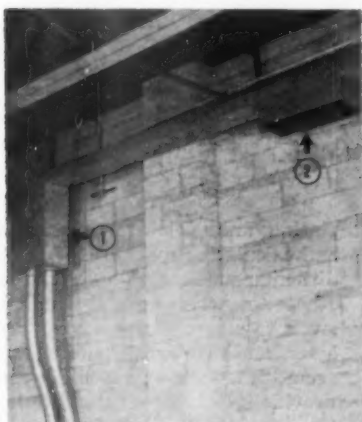
All underground feeders and individual store service taps are made to the concealed bus duct in accessible junction boxes extending below the ceiling level.

Three interested inspection agencies approached this new design with an open mind and in a cooperative spirit. Each carefully considered the factors involved and carefully studied the proposed layout. Approval of the design and installation was granted by representatives of the Indiana State Fire Marshal's office, the Gary City Electrical Department and officials of the Northern Indiana Public Service Company.

System Advantages

Prime selling feature of the bus duct service entrance design is the complete electrical flexibility it offers the shopping center owner. Load characteristics of individual tenants can change, but the service capacity will always be available. Should there be a change of tenants, an enlarging of a store, or a combination of two stores, the 10-ft conduit and wire riser need only be changed. If a tremendous load is added, an insert can be placed in the bus duct and additional copper feeders can be pulled in the spare conduit to secure the required capacity.

Because of the busway design, no fused protection is provided between the primary side of each transformer and the first thermal breaker in each store.



BUS DUCT SERVICE ENTRANCE consists of a run of 600-amp, 3-phase, 4-wire, low-impedance, aluminum bus duct mounted to roof steel above ceiling line. Secondary feeders from substation terminate in center tap box (1). Service taps for individual stores are provided by cable tap-boxes (2).



DUCT IS CONCEALED in crawl space between suspended plaster and acoustical tile ceilings and metal pan roof deck. Each individual store has an access door to this crawl space. Fire walls separate stores.



SERVICE TAP BOXES on duct extend below ceiling line in each store; enclose bus bar extensions with solderless cable lugs. Screw cover is split with one section accommodating service conduit drop. Other section encloses service cable connections.



COMPLETED SERVICE to a store is checked by Sweney general foreman Charles McArty. Note service drop from concealed bus duct to current transformer cabinet (lower left). Power and lighting distribution panels are on the right. A change in this service would involve only work on equipment shown. The bus duct service entrance remains intact.

The system eliminates a spider web of service drops and keeps the exterior of the building clear of any electrical equipment. Not a foot of conduit or wire is mounted on the outside walls. Also, valuable parking area space is gained.

With this electrical system, as installed, Sweney engineers feel they have found a practical solution to the electrical distribution problems of a shopping center. In one package, they have combined economy, flexibility, safety and appearance.



PRESS LINE, one of five operated by the Inquirer, includes hundreds of motors, press and tension control stations, limit switches, tiering machines, lights and signals; all demanding dependable maintenance by 40-man department working on 3-shift round-the-clock rotation.

ELECTRICAL MAINTENANCE

... in a Newspaper Plant

Production marathon of metropolitan news center—demanding constant service from thousands of electrical motors and controls—must rely upon *preventive* maintenance in its fullest meaning. Leading Philadelphia newspaper obtains this service from electrical contractor John F. McCarthy.

THE Philadelphia Inquirer is a thriving newsplant with a 5-million-a-week circulation. In addition to daily and Sunday editions, however, the Inquirer also prints a national section for TV Guide (to the extent of some 75-million copies a week), while several nationally-circulated magazines likewise come into being on Inquirer presses under the banner of Triangle Publications.

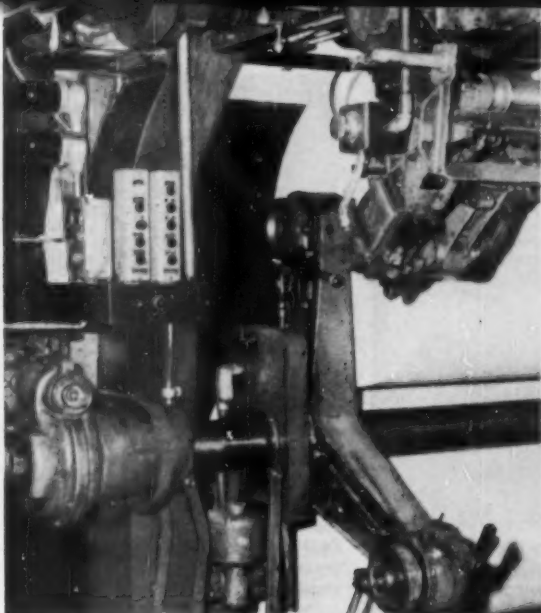
Since this wide-scoped printing assignment includes considerable rotogravure and color work in addition to conventional black-and-

white, both quantity and quality statistics are impressive. Printing, however, is only one segment of the Inquirer's diversified program, for the block-square plant also contains large departments for photography, engraving and electrotyping, journalism and business, radio and television, wire services, paper receiving, storage and shipping.

Translated into electrical terms these many activities demand the uninterrupted services of pumps, presses, solvent recovery equipment, signalling devices, electro-

plating units, elevators, conveyors and calculating machines. Air conditioning units must maintain constant temperature and humidity levels to insure uniform color processes, and over 4000 motors, rated from fractional to 300-hp must provide positive service to keep this mammoth newsplant on its critical cycle of constantly repetitive deadlines.

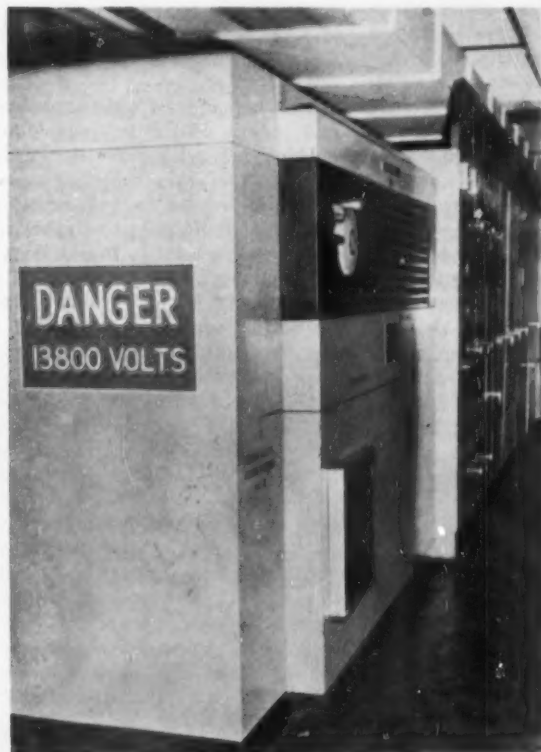
Since a major shutdown of electrical production or distribution equipment would be reflected promptly in curtailed circulation and revenue, the responsibility for



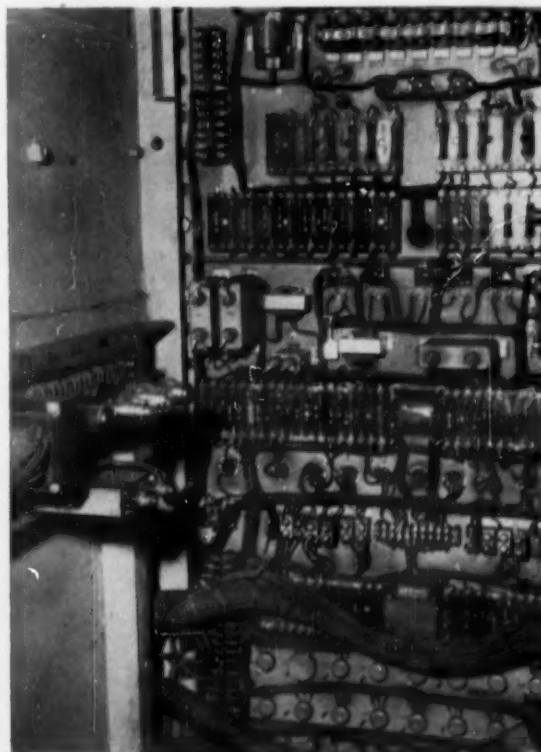
MULTIPLE MOTORS of group-drive press lines obtain power from overhead plug-in busduct. Local pushbutton stations activate remote electronic control boards.



5-MILLION PAPERS a week is only one of several publication requirements; others include color rotogravure, 75-million TV sections and several national magazines.



SWITCHGEAR for unit press drives is fully-enclosed, with drawout breakers, safety interlocks, indicating lights and bus diagrams for positive identification.



ELECTRONIC control and ignitron rectifier cubicles are intricately wired assemblies, requiring accurate circuiting and regulation of components.

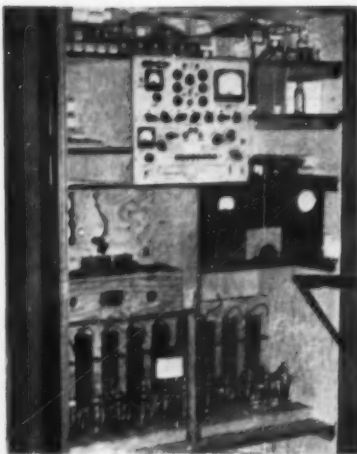
maintaining the electrical system in top-flight condition could justly be classed as the publication's keystone—the strength of which determines the stability of all other ac-

tivities in the plant. And, since the Inquirer operates around-the-clock, seven days a week, this assignment amply justifies the existence of a 40-man electrical maintenance de-

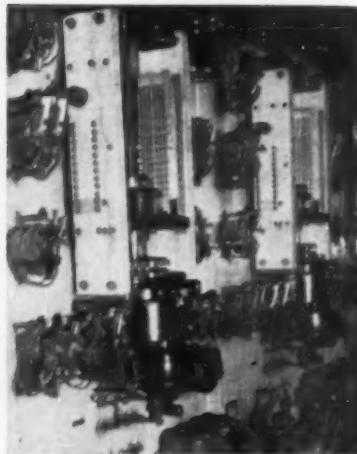
partment, working on a 3-shift continuous schedule. Electricians are members of IBEW Local 98, with apprentices receiving a 5-year general training course (four days a



ADJUSTMENT of automatic electronic equipment is exacting maintenance job, but resulting refinements of press-drive control justify this attention to details.



TUBE TESTING center is conveniently incorporated at tube storage station. Operation of electronic equipment is regularly checked by oscilloscopes.



OLDER CONTROL panels for group-drive presses are worm-magnetic units; this inclusion of old equipment greatly broadening the maintenance scope.

week spent as a journeyman assistant; one day in Union-sponsored school), and all employees receiving special training, from manufacturers' engineers, whenever new or special electrical equipment is installed. Foremen for each shift report directly to electrical maintenance supervisor John Wenrich, who in turn reports to the independent contracting firm of John F. McCarthy, Inc.

With on-the-jobsite offices, stock bins, maintenance equipment, machine tools and testing centers located within the Inquirer plant, yet with auxiliary motor-repair facilities and an augmented stock of material and equipment located

at the McCarthy shop (only a stone's-throw distant), this maintenance set-up combines the best features of an in-plant maintenance department and an outside-contract organization specializing in this type of work. Men in constant attendance are available for routine and emergency service, yet the close relation with an organization specializing in this field makes it possible to obtain part-time use of specialists and special equipment whenever this becomes necessary or expedient. Since a maintenance company with many contracts of a similar nature can justify the cost of these special skills and tools (whereas a single self-dependent

company could not), this extra service and protection constitutes an economical bonus for all concerned.

Wide Range of Equipment

This demand for wide experience and many skills is particularly evidenced in the case of the Inquirer, for this bustling news center is housed in two adjacent, connected buildings; one sparkling new, the other in its fourth decade of occupancy. This combination of the new with the old is emphasized by noting equipment contained in the two buildings, for switchgear ranges from old free-standing exposed-wiring knife-switch-and-fuse boards to fully-enclosed high-voltage load centers with draw-out breakers and safety interlocks; press drive controls including 30-year-old worm-drive magnetic units as well as modern fully-automatic electronic and ignitron rectifier assemblies, and press arrangements including both dc group-drive and ac unit-drive hook-ups.

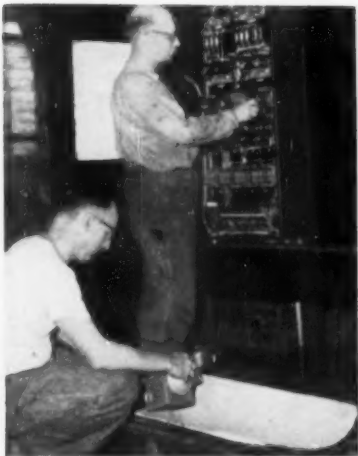
This latter fact covers widely-dissimilar equipment and arrangements because, with grouped presses, both the main and paper-threading motors are mounted on common bedplates as integral units connected to press drive shafts by V-belt transmissions; the starting motors being connected via gear reductions and over-travel electromagnetic clutches. Drive units are large compound-wound adjustable-speed units geared to presses to obtain approximately 150-rpm for



MACHINE AND MOTOR repair shops are located near supervisor's office, making it possible for him to check status of all such jobs without having to travel or call to remote sections of the plant.



RANGE OF SKILL and experience is likewise extended due to existence of old free-standing exposed-wiring knife-switch and fused distribution centers.



MEGGER is operated and read by electrician while partner probes contacts of remote control panel. Maintenance department uses numerous instruments.



MOTOR MAINTENANCE includes replacement and adjustment of carbon brushes, cleaning of commutator, lubrication, checking of bearings and the like.

plate cylinders when motors run at normal speeds with full voltage. Slowdown for take-off or registering is here obtained by armature series resistance. When several presses are used together, motors are arranged for parallel operation through mechanical linkage of control clutches.

Unit drives, on the other hand, have main slip-ring induction motors for each separate press unit and folder; starting, inching and running at variable speeds being instrumented by electronic controls

that vary the current in one phase of the primaries. Starting and threading motors are squirrel-cage high-torque induction units.

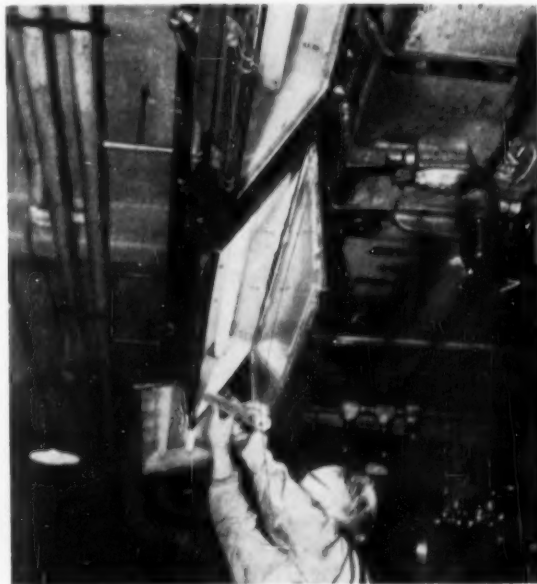
Press controllers, combining fully-automatic panels with remote-control pushbutton stations mounted on presses, embody main-circuit disconnecting devices, contactors for connecting and disconnecting motors to power supply, magnetic instantaneous-trip overloads for main motors and thermal overloads for threading motors, commutating devices for accelerat-

ing and decelerating main drive motors, control relays for signal systems and various safety features, and stopping means with both dynamic and magnetic braking.

With the unit drives, any number of press units can be operated in parallel. Control is more exact and positive, but maintenance of related control equipment is far more exacting and critical; a fact that places added responsibility upon the electrical maintenance department.



WASHING of motor parts with solvent is standard procedure whenever motor is disassembled for repair. Here supervisor John Wenrich checks the job.



VAPORPROOF fluorescent fixtures are inclined inwards along presses to direct light towards center of operations. Relamping schedule keeps light output high.



INSTRUMENTS used by Inquirer maintenance department include liberal array of oscilloscopes, industrial analysers, volt-, ohm- and ammeters, Meggers, light meters, tachometers and the like. Revealing accurate operating conditions, these instruments take the guesswork out of analysis.



RECHARGING of wet-cell batteries used to power industrial trucks is still another responsibility of the electrical maintenance department.

Oscilloscopes Check Controls

In this connection, the use of oscilloscopes is of tremendous value, for actual scope traces can be quickly checked against key patterns that reflect either satisfactory adjustment and operation of the electronic control equipment, or the nature and extent of necessary corrective measures to be taken. Key scope patterns are contained in handy book form, while detailed wiring diagrams with tube positions and other pertinent data are wall-mounted adjacent to their

corresponding cabinets, thereby providing instant reference sources for maintenance men.

Oscilloscopes are dolly-mounted for convenient movement of equipment, and complete tube-testing equipment is conveniently located at a central tube-storage supply depot.

In addition to scopes, the Inquirer maintenance department employs such additional recording and indicating instruments as volt-, ohm- and ammeters, industrial analysers, Meggers, tachometers, light-meters and the like. These

instruments—collectively revealing circuit and equipment operating characteristics—take all guesswork out of analysis, leave little to imagination, insure accurate diagnosis, and so promote the objectives and interests of factual preventive maintenance.

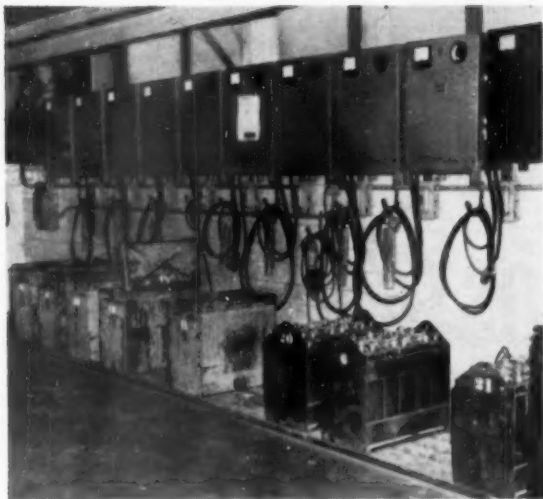
Scope of this electrical maintenance endeavor is extensive, for it includes not only press drives and control boards, automatic pasters and tension motors, type-metal heaters and stereotype foundries, but such related equipment as reel brakes and exhaust fans, motorized saws and miters, condensing units and such photographic equipment as print dryers, enlargers and printers as well. In addition, it covers the maintenance of mailing machines and postage printers, a secondary clock system, vacuum pumps, stuffing and tying machines, battery lift-trucks and hoists, and both chain- and belt-conveyors. This is a comprehensive assignment, for motors vary widely in characteristics, ratings and applications, and controls include an unusually wide assortment of sensing elements and operating mechanisms.

Aside from maintaining machines and operating equipment, the department also maintains power and lighting secondary systems, lighting fixtures and (on an emergency basis during night-time and weekend shifts) the plant's numerous elevators. This category of responsibility is likewise a broad one, for distribution equipment ranges from transformers to busducts, while lighting equipment includes mercury units as well as vapor-proof fluorescents and incandescent fixtures.

The repair of power tools is also included in this overall maintenance program, as is the checking, recalibration and adjustment of meters and testing units. So, in addition to an extensive variety of skills, the department understandably demands an equally-extensive inventory of replacement parts, fully-equipped machine and motor-repair shops, several sizable battery-charging stations and an impressive assortment of hand and power tools to instrument this work.

Up-to-date Records

To promote the pinpointing and diagnosis of trouble, wiring dia-



STATIONS for battery recharging are located in three separate sections of the plant so that fork-lifts and industrial trucks can be serviced with a minimum of travel and delay. These stations, like all other maintenance centers in the plant, reflect accent on cleanliness, safety and efficiency.



WELDING center includes six dc units with dual continuous controls, providing right type of arcs and proper intensity for each specific job. Units have liberal overload capacity to insure good life, performance and protection against burn-outs. Units are stationary, with ac power input provisions.

grams of all systems and electrical assemblies are promptly corrected whenever any changes or additions take place; equipment record cards show the nature and extent of all past service requirements; perpetual inventories show use-frequency and residual levels of all replacement items, while complete daily order logs provide an accurate reference source whenever explicit details are desired for specific purposes.

Wiring diagrams are conveniently mounted on both front and rear sides of thin plywood backing sheets which, in turn, are supported page-like by removable pivot pins and wall-mounted brackets. This arrangement makes it possible for a maintenance man to quickly flip plan sheets left or right for momentary reference; un-pin a plywood sheet for closer horizontal study, take-off or additional drafting, or to carry the plans around the plant with him for on-the-spot checking or correction of details.

Orderly classification and storage of inventory stock is obtained through the use of numerous tiered bins and cabinets arranged along aisles located adjacent to office personnel handling phone calls, daily work logs, duty assignments, inventory withdrawals and the requisitioning of parts for stock replacement. Rolling stepladders are provided to facilitate reaching

bins on upper tiers, and lockers are also located in this same area for the protection of expensive testing equipment, vacuum tubes and similar items.

The machine and motor-repair shops are also located near this center of control, making it possible for the maintenance supervisor or his foremen to direct or check the status of all such repair assignments without having to travel to a remote section of the plant. With the exception of major

rewinds, this service area is completely self-sufficient.

The objectives of maintenance are clearly defined at the Inquirer plant, for they realize that (1) physical facilities must be kept in good repair to produce a product of high quality at maximum speed on rigid schedules and at minimum cost to meet competition while returning a fair profit, (2) manpower and materials must be conserved wherever possible, (3) the life of expensive and hard-to-get equipment must be prolonged for reasons of economy as well as conservation, (4) the ever-widening scope of electrical and electronic operation demands up-to-the-minute maintenance know-how, and (5) the permissible cost of maintenance must be kept in line with overall plant income. These maintenance charges are admittedly sizeable, yet the Inquirer takes the wise attitude that money saved by minimizing maintenance is false economy.

The fact that the Inquirer's grueling production marathon has had practically no serious interruptions is a tribute to rigid maintenance inspection schedules, the technical aptitude of workers, exact control and regulation of equipment, and unfailing attention to details. This record is the justification for the department's existence and it emphasizes the meaning of preventive maintenance in its fullest sense.



WIRING DIAGRAMS are mounted on plywood sheets pivoted by detachable pins supported by wall brackets. Sheets may be detached for study or drafting.

How To Make

1956 TOOL COST STUDIES

... for use in arriving at reasonable monthly charges for construction tools. Factors affecting such costs are explained.

By Ray Ashley, Research and Consulting Engineer, Oak Park, Ill.

NOT TOO many years back, electrical contractors were giving little or no thought to tool costs. Tools were purchased, put on the books as overhead, and that was that. Prior to 1938, no extensive investigation of subject was made. In that year, a study of the cost of tools used in the electrical construction industry was initiated in Chicago by Norman Pierce, Sr., president of Pierce Electric Company. As always, members of the Chicago Electrical Estimators Association were ready to assist in worthwhile research and with their cooperation, the author prepared tables similar to those shown in Figs. 1 and 2.

The following year the author presented the results of the Chicago research in a paper entitled *Neglected Costs*. Since that time the results of tool cost studies have been widely promulgated in talks before electric contractor associations and by articles in the electrical construction press. Now, the practice of charging for tools is becoming general among electrical contractors. Some figure approximately 3% of the labor cost; others include tool charges along with labor insurances, engineering, cartage and other direct job costs.

Regardless of the method employed in billing, the contractor

must be prepared to explain and defend his tool charges. You may say they are based on research. Suppose he asks you to substantiate your charges. You must be in a position to explain the basic factors which affect tool costs and understand how the figures are developed. Details or the procedure for studying tool costs will be covered in the succeeding paragraphs.

For example, your customer may pick an individual tool such as a power driven threader and ask you to substantiate a charge of \$23.00 per month for an item that has an initial cost of \$300.00 and a nominal writeoff of \$2.50 per month for depreciation. The approximate life of such a tool is ten years, or 120 months. Dividing \$300.00 by 120 gives the \$2.50 figure.

Factors Affecting Tool Costs

More than mere depreciation enters into the development of a tool cost charge. Three specific factors must be dealt with when establishing tool charges. They are:

1. Time in Actual Use
2. Fixed Costs
3. Individual Job Costs

TIME IN USE

One must not confuse the term Time in Use with Rated Life. *Rated*

Life is the period in which the tool may be available for economical use. *Time in Use* is the time that the tool is actually in use or available for use on the job. The rated life may be ten years, but the time in use may not be more than three or four years.

Let us study the possible time in use during a 10-year period for the power driven thread cutter. Ten years serves well because it is the rated life of thread cutters, band saws and many other heavy tools. Besides, the cycles in business are usually about ten years duration. Construction cycles generally consist of seven good years and three bad ones.

Time in use for a power driven thread cutter would then be estimated as follows:

- 7 good years at 60% . . . 4.2 yrs.
- 2 bad years at 20% . . . 0.6 yrs.
- 1 year obsolescence . . . 0.0 yrs.

Total Time in Use . . . 4.8 yrs.
or 57.6 months
(Use 58 months)

FIXED COSTS

The fixed charges on a tool consist of original purchase price, interest on investment and insurance. When figuring the interest costs it is assumed that the depreciation is uniform over the 10-year period.

ESTIMATED COST OF TOOLS TO EQUIP A JOB REQUIRING A CREW OF FIFTY ELECTRICIANS

ITEM	REMARKS	NO IN USE	PURCHASE PRICE EACH	TOTAL COST THE LOT	DEPRECIATION & INT ON INVEST PER MO. EACH		ESTIMATED STORAGE & REPAIRS PER MO. EACH	TOTAL COST PER MONTH	
					PERCENT	DOLLARS		EACH	THE LOT
ELECT DRILLS	1/4 IN	4	45.00	180.00	5.5	2.75	0.50	2.90	11.60
ELECT DRILLS	1/2 IN	2	70.00	140.00	5.5	3.85	0.50	4.35	8.70
STEP LADDERS	8 FT	6	15.00	90.00	2.0	3.00	0.50	3.50	21.00
STEP LADDERS	12 FT	6	24.00	144.00	2.5	6.00	0.50	6.50	39.00
STEP LADDERS	14 FT	5	35.00	175.00	3.0	10.50	0.50	11.00	55.00
STEEL LADDERS	32 FT	1	35.00	35.00	10	3.50	0.50	4.00	4.00
PIPE BENCHES	SMALL	50	23.00	1150.00	5	1.15	0.25	1.40	70.00
PIPE BENCHES	LARGE	5	30.00	150.00	5	1.50	0.25	1.75	8.75
PIPE VISE	1/2 IN TO 2 IN	5	11.00	55.00	4	4.40	0.25	4.65	23.25
PIPE VISE	2 IN TO 3 1/2 IN	5	19.00	95.00	4	7.60	0.25	7.85	39.25
STOCKS	1/2" - 3/4" - 1"	6	17.00	102.00	4	6.80	0.50	7.30	43.80
STOCKS	1 1/4" TO 2"	6	25.00	150.00	10	15.00	0.50	15.50	93.00
STOCKS	2" HATCHET	5	38.00	190.00	10	38.00	0.50	38.50	192.50
STOCKS	2 1/2" TO 4"	5	115.00	575.00	10	115.00	0.50	115.50	577.50
THREAD CUTTER	POWER DRIVE	2	300.00	600.00	5	30.00	0.50	30.50	61.00
PIPE VISE	1/2" & 3/4"	10	3.00	30.00	5	1.50	0.25	1.75	17.50
PIPE DIES	1" & 1 1/4"	5	3.50	17.50	5	1.75	0.25	2.00	10.00
PIPE DIES	2"	4	6.00	24.00	5	3.00	0.25	3.25	13.00
PIPE DIES	2 1/2"	3	10.00	30.00	5	5.00	0.25	5.25	15.75
PIPE DIES	3"	3	10.00	30.00	5	5.00	0.25	5.25	15.75
PIPE DIES	4"	3	10.00	30.00	5	5.00	0.25	5.25	15.75
HICKIES	1/2" TO 1"	15	5.00	75.00	10	37.50	0.25	37.75	566.25
POWER SAW	LARGE, BAND	1	710.00	710.00	5	35.50	0.50	36.00	36.00
PIPE BENDERS	SMALL	2	202.00	404.00	5	10.10	0.50	10.60	21.20
PIPE BENDERS	LARGE	1	800.00	800.00	5	40.00	0.50	40.50	40.50
TOOL BOXES	WOOD	4	35.00	140.00	10	35.00	0.50	35.50	142.00
TOOL BOXES	STEEL	8	35.00	280.00	5	14.00	0.50	14.50	116.00
WIND DRILLS		3	35.00	105.00	5	17.50	0.50	18.00	54.00
WINCHES	HAND DRIVE	2	20.00	40.00	5	10.00	0.50	10.50	21.00
WINCHES	POWER DRIVE	2	180.00	360.00	5	9.00	0.50	9.50	19.00
JACKS	STUB	2	150.00	300.00	4	6.00	0.50	6.50	13.00
JACKS	REEL	12	35.00	420.00	4	1.40	0.50	1.90	22.80
FISH TAPE	1/8" - 10'	5	2.75	13.75	50	6.88	0.50	7.38	36.90
FISH TAPE	3/16" - 10'	4	3.50	14.00	50	7.00	0.50	7.50	30.00
FISH TAPE	1/4" - 200'	2	8.00	16.00	25	4.00	0.50	4.50	9.00
BLEEDS	SNATCH & MISC	2	7.00	14.00	25	3.50	0.50	4.00	8.00
ROPE - HEMP	1/2" - 20'	5	2.00	10.00	20	4.00	0.50	4.50	22.50
ROPE - HEMP	3/4" - 200'	1	15.50	15.50	20	3.10	0.50	3.60	3.60
ROPE - WIRE	1/2" - 150'	2	25.00	50.00	10	2.50	0.50	3.00	6.00
ROPE - WIRE	1/2" - 200'	2	40.00	80.00	10	4.00	0.50	4.50	9.00
CHAIN HOIST	1 TO 3 TON - 10' LIFT	1	270.00	270.00	5	13.50	0.50	14.00	14.00
WAGON TRUCKS		3	50.00	150.00	5	7.50	0.50	8.00	24.00
WELTNEY PUNCHES/DRILLS	MISC. - SETS	4	55.00	220.00	5	11.00	0.50	11.50	46.00
WELTNEY PUNCHES/DRILLS	50' COMP. GUARDIAN	15	8.00	120.00	15	1.20	0.50	1.70	25.50
MOTOR GEN SET		1	195.00	195.00	5	9.75	0.50	10.25	10.25
GAS FURNACE	PLUMBERS	2	35.00	70.00	4	1.40	0.50	1.90	3.80
GAS TANKS & BURNERS	COMPRESSED GAS	4	50.00	200.00	4	2.00	0.50	2.50	10.00
R.O. PLYCHES		4	12.00	48.00	20	2.40	0.50	2.90	11.60
PIPE WRENCHES	18"	10	5.00	50.00	10	5.00	0.50	5.50	55.00
PIPE WRENCHES	24"	5	8.75	43.75	10	8.75	0.50	9.25	46.25
CHAIN TONGS	MISC	3	18.00	54.00	10	1.80	0.50	2.30	6.90
CABLE PULLER	"CONE ALONG"	5	20.00	100.00	5	10.00	0.50	10.50	52.50
SCAFFOLDING	ROLLING & MISC	20	15.00	300.00	10	30.00	0.50	30.50	610.00
STEAM DRILLS		6	1.00	6.00	20	1.20	0.50	1.70	10.20
REAMERS	MISC - RATCHET	30	7.00	210.00	10	21.00	0.50	21.50	645.00
FILES	MISC	30	1.00	30.00	10	3.00	0.50	3.50	105.00
TRIST DRILLS	MISC	20	1.00	20.00	10	2.00	0.50	2.50	50.00
TAPS	MISC	20	1.00	20.00	10	2.00	0.50	2.50	50.00
OLLERS	MISC	20	1.00	20.00	10	2.00	0.50	2.50	50.00
HAMMERS & PLEUGES	MISC	6	2.00	12.00	10	1.20	0.50	1.70	10.20
DRILL POINTS	MISC	6	2.00	12.00	10	1.20	0.50	1.70	10.20
LOCKS & CHAINS		20	4.00	80.00	8	3.20	0.50	3.70	74.00
HACK BLADES		300	1.00	300.00	10	30.00	0.50	30.50	9150.00
SHOP SUPPLIES & MISC	SMALLS, WASTE OIL, ETC	200	20.00	400.00	10	20.00	0.50	20.50	4100.00
SHOP SUPPLIES & MISC	SHOP TOOLS	200	100.00	200.00	10	20.00	0.50	20.50	4100.00
TOTALS			4,210.00	8,906.00	30.42	325.92	1.00	326.92	926.32

A 10 PERCENT CHARGE IS INCLUDED FOR HANDLING AND STORAGE WHEN NOT IN USE.

PREPARED BY RAY ASHLEY - 9/15/56

FIG. 1—Estimated cost of tools for a project requiring 50 electricians showing a cost breakdown per tool item with monthly cost analyses. Note depreciation, interest, storage and repair factors.

THE COST OF A POWER DRIVEN THREAD CUTTER IS ESTIMATED AS FOLLOWS

I — Fixed Costs

Purchase Price	\$300.00
Interest on Investment	
5% for 10 yrs. on \$150 ($\$300 \div 2$)	75.00
Insurance — usually carried by contractor —	
0.5% for 10 yrs.	15.00
Complete cleaning and painting and some	
overhauling (once every 2 years) — $5 \times \$20$	100.00
Total Fixed Cost for 10 years	\$490.00
Time in Use — 58 months (based on normal construction cycle)	
Fixed Costs for 58 months of actual use	\$490.00
Fixed Cost per month ($\$490 \div 58$)	\$8.45

II — Individual Job Expense — Prorata Cost per Month While in Use, Based on 3 Months on the Particular Job

Cartage (out and back at \$6.00 each)	
$\$12.00 \div 3$	\$4.00
Handling Labor (out and back at \$4.50 each)	
$\$9.00 \div 3$	3.00
Repairs while on Job — Avg. \$4.00 per month	4.00
Total Prorata Job Expense Per Month	\$11.00

Summary of Costs per Month

I — Fixed Costs	\$ 8.45
II — Individual Job Expense	11.00
	\$19.45
General Overhead plus Insurance on Labor	
(Shipping and Maintenance) — 20%	3.89
Total Cost per Month	\$23.35
Use \$23.00 per month	

Hence, the total amount of interest is equal to the normal rate for ten years on half the original purchase price (see accompanying estimate).

The insurance is usually carried by the contractor. Nevertheless, it is an expense that must be included.

INDIVIDUAL JOB EXPENSE

Charged to the individual job are the expense of cartage and handling (transportation from shop to job and back) and costs of repairs. Repairs must be prorated. A tool may go through one or more jobs without repairs. Then, on another job, tool repair expense may be substantial.

Tool Life Varies

The life of a given tool will vary considerably with the type of work. This is particularly true of ladders, ropes, fish tapes and other tools subject to varying loads and abuses. A ladder used for trim and light conduit work will naturally stand up much longer than one used for heavy conduit or equipment. Ropes, not used properly, can have a very short life.

Some contractors erroneously

think that tools have a long life because they lay around the shop for a long time. Idle tools in the shop, and on the job, may result from mechanics' reluctance to use them.

No contractor should discount estimated tool cost figures, such as those illustrated, until he can prove some error. There will be times when the estimated costs must be varied. Light intermittent duty may justify a reduction. For projects with a great deal of overtime, the costs must be increased.

1956 Tool Costs

FOR A CREW OF 50

Fig. 1 gives a list of tools for a job requiring a crew of 50 electricians. The list is compiled with the idea of getting a cost that normally would be experienced. It is by no means a listing of all the tools in common use on large projects. In addition to a long list of small tools that might be added, there are large shop tools, portable compressors, surveyor's levels, fork-lift trucks and numerous other costly items. To include all the tools that might be found in use on various jobs

would produce an estimated cost in excess of common experience.

The estimated monthly cost of tools for a 50-man crew is indicated in Fig. 1 as \$926.00. With a labor rate of \$3.00 per hour and a 40-hour week, the cost would represent approximately 3.6% of payroll. For a \$3.50 per hour rate, the monthly tool cost would approximate 3% of payroll. Tool cost also will vary with the type and size of project and the adequacy of tools.

Since 1945, the cost of labor has increased faster than the cost of tools. However, the cost of tools for a 50-man crew is about the same when expressed as a percentage of payroll. For smaller projects, the percentage of cost has increased, since the number of expensive tools on smaller jobs has increased. Also, there has been some increase in the use of moderate priced tools. Greatest increase in tool usage appears to be in the categories of rolling scaffolds, wagon trucks and lift platforms. A study of tool costs for a 5-man crew will show the effects of job size.

FOR A CREW OF FIVE

The estimated tool cost per month for an industrial project requiring a crew of five electricians is shown in Fig. 2. The monthly cost of \$183.00 represents approximately 6% of a \$3.50 per hour payroll. In 1945, the estimated cost of tools to equip such a job was about 5.5% of a \$1.70 per hour payroll.

As time goes on, the gap between the cost of tools for large and small jobs will be greater (on a percentage of payroll basis). Contractors find that expensive manpower saving tools are economical on small as well as large projects. Also, mechanics become accustomed to working with the better tools and expect to find them on the job.

As illustrated in Figs. 1 and 2, the cost of tools per man-day is much greater for a five-man crew than it is for a 50-man crew. Studies show that the cost levels off as the size of the crew approaches 50 men. Above the 50-man level, there is little change. There are several reasons for this. The principal one is that a 50-man crew proves to be an economical unit.

Billing for Tools

In competitive bidding, tools are included in the estimate with other direct job costs. On Cost-Plus work, they may be billed:

**ESTIMATED COST PER MONTH FOR TOOLS TO EQUIP AN INDUSTRIAL
JOB REQUIRING A CREW OF FIVE ELECTRICIANS**

ITEM	NO. IN USE	PURCHASE PRICE EACH	PRICE LOT	JOB COST PER MONTH EACH	THE LOT
Electric Drills — ¼"	1	\$ 45.00	\$ 45.00	\$ 2.95	\$ 2.95
Electric Drills — ½"	1	70.00	70.00	4.45	4.45
Step Ladders — 8 Ft.	1	15.00	15.00	3.00	3.00
Step Ladders — 12 Ft.	2	24.00	48.00	6.50	13.00
Step Ladders — 14 Ft.	1	35.00	35.00	11.00	11.00
Pipe Benches — small	2	23.00	46.00	1.15	2.30
Pipe Benches — large	1	30.00	30.00	1.80	1.80
Pipe Vise — ½" to 2"	2	11.00	22.00	.70	1.40
Pipe Vise — 2" to 3½"	1	19.00	19.00	1.25	1.25
Stocks — ½" to 1"	2	17.00	34.00	1.70	3.40
Stocks — 1¼" to 1½"	1	25.00	25.00	2.50	2.50
Stocks — 2" Ratchet	1	38.00	38.00	4.10	4.10
Stocks — 2½" to 4"	1	115.00	115.00	7.75	7.75
Pipe Dies — ½" to ¾"	4	3.60	14.40	2.15	8.60
Pipe Dies — 1" to 1¼"	2	5.50	11.00	3.30	6.60
Pipe Dies — 2"	1	6.00	6.00	2.40	2.40
Pipe Dies — 2½"	1	10.00	10.00	2.50	2.50
Pipe Dies — 3"	1	10.00	10.00	2.50	2.50
Pipe Dies — 4"	1	12.00	12.00	2.40	2.40
Hickies — Misc. ½" to 1"	5	5.00	25.00	.50	2.50
Pipe Benders — small	1	200.00	200.00	12.00	12.00
Tool Boxes — large wood	1	50.00	50.00	5.00	5.00
Tool Boxes — Steel	2	35.00	70.00	1.75	3.50
Rope — Hemp ½" 100 Ft.	1	4.00	4.00	2.00	2.00
Rope — Hemp ¾" 100 Ft.	1	7.50	7.50	5.00	5.00
Scaffolding — Rolling	1	250.00	250.00	20.00	20.00
Wagon Trucks	2	50.00	100.00	5.00	10.00
Chain Hoist — Five ton, 10 Ft. lift	1	270.00	270.00	6.00	6.00
Extension Cords — 50 Ft. Heavy duty	2	8.00	16.00	1.50	3.00
Gas Furnace — Plumbers	1	35.00	35.00	2.50	2.50
Pipe Wrenches — 18"	2	5.00	10.00	.50	1.00
Pipe Wrenches — 24"	2	8.75	17.50	.90	1.80
Chain Tongs	2	18.00	36.00	1.75	3.50
Reamers — Misc. Ratchet	3	15.00	45.00	2.00	6.00
Oilers	4	.50	2.00	.15	.60
Knock-out Punches	1	10.00	10.00	2.00	2.00
Locks and Chains	4	4.00	16.00	.30	1.20
Hacksaw Blades	30	.10	3.00	.10	3.00
Files — Misc.	5	.70	3.50	.35	1.75
Misc. — Hammers, Drills & Misc.			20.00	2.00	2.00
Shop Supplies			5.00		5.00
Total			\$1,800.90		\$183.25

FIG. 2—Tool equipment for economical operation of a 5-man crew involves a substantial investment. Job cost per month for tool items are in right hand columns.

1. As a percentage of payroll
2. On a rental basis
3. As a material item (sold directly to the job)

The simplest method of billing is that of charging a percentage of payroll. Some contracts call for tools to be billed on a rental basis. In that case, so much per month is billed for each of the depreciated tools. Consumed tools such as drills, taps, hacksaw blades and similar

items, are charged directly to the job the same as material.

On many large Cost-Plus projects, the tools are purchased new and charged directly to the job. At the completion of the contract, these tools are turned over to the owner or the contractor buys them at a determined salvage price.

We have been studying industrial projects. Cost of tools generally runs higher for office and other

commercial building electrical construction work. Tools are tied up longer for the same man-hours on this type of project.

Each contractor must study his own costs and figure tools accordingly. He must not overlook any of the many expense items involved in the supply and maintenance of tools. They represent a substantial item of job cost and must not be treated as an incidental item of overhead.

CENTRAL PANEL PROVIDES Electric Heating-Cooling Control



Low-voltage ground-return circuits permit heaters and air conditioners in unoccupied units to be controlled from motel office.

CONTROL PANEL in motel office contains toggle switches for on-off operation of heating and cooling circuits in each motel unit. Space is available on panel to accommodate circuits serving future expansion.

CENTRAL manual cutoff switches provide individual control of low-voltage thermostat circuits for electrical heating and cooling equipment in each unit of Hinton's Motor Lodge in Irving, Texas. The 30-suite project, including a 20 by 40-ft lounge and a conference room, is the first installation of the new control system developed by Minneapolis-Honeywell. The system

serves 107.25 kilowatts of electric glass panel heaters on the winter cycle and built-in unit air conditioners during the cooling season.

A panel in the motel office contains a single-pole, single-throw, on-off toggle switch for each motel unit, making it possible to render the individual thermostats in the room inoperable. Operating the heaters and air conditioners in

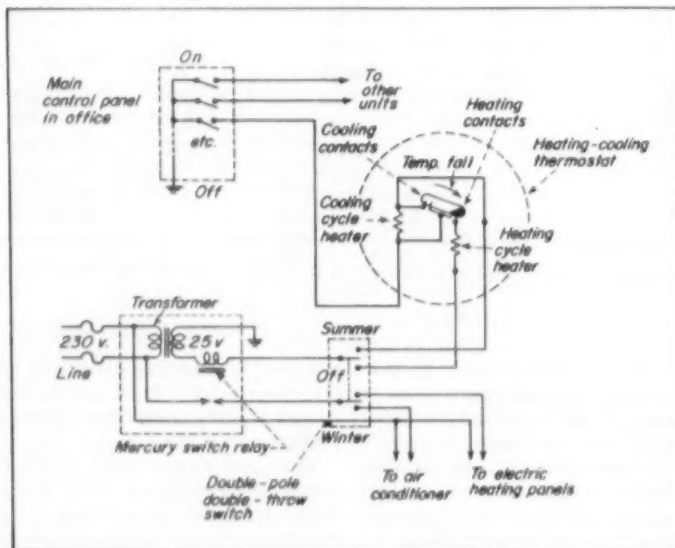
each unit is a heating-cooling thermostat, a transformer-relay unit and a summer-winter switch.

The advantage of this arrangement lies in the convenience of being able to shut off or turn on the heating or cooling equipment in any unit from the motel office without individual trips each time the unit is occupied or vacated. The heat (or cooling) of the next room (or rooms) in line to be rented may be turned on in advance, assuring a comfortable temperature by the time the guest arrives. When the occupant checks out, a flip of the switch turns off the system in the vacated room.

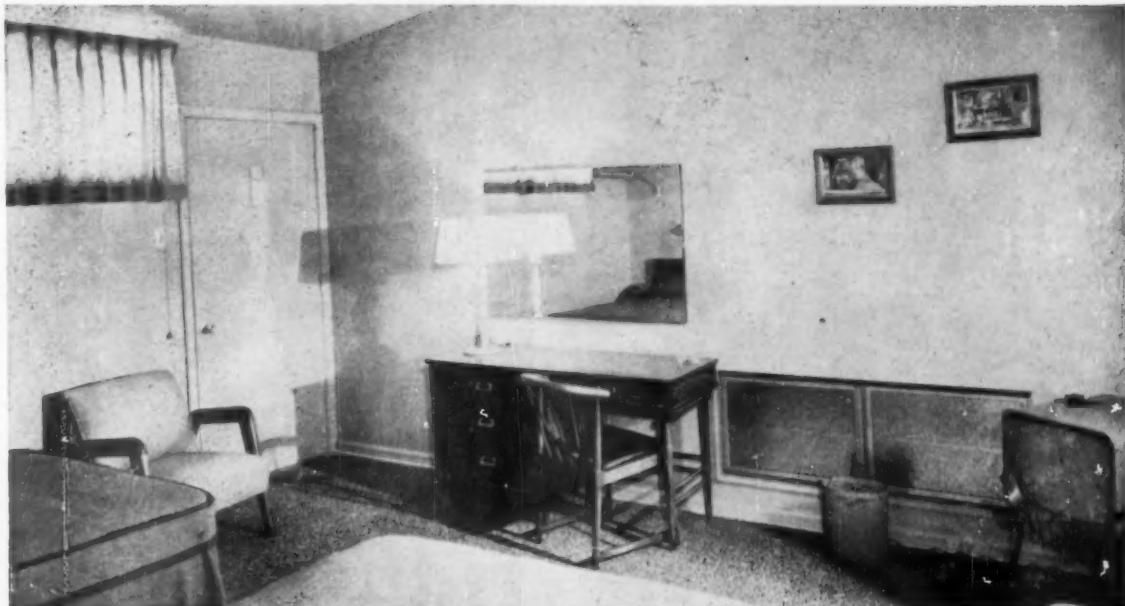
Prevailing winter weather in the area (2367 degree-days) makes it unnecessary to maintain a constant level of heat in unoccupied rooms. Heat loss was reduced considerably by the installation of 3-in. mineral wool insulating batts in the walls and ceilings.

How Control Operates

With the summer-winter switch on "winter", closing of the thermostat heating contacts completes the secondary circuit of the transformer, energizing the relay and closing the 230-volt line circuit to the electric heaters. With the switch on "summer", closing of the thermostat cooling contacts completes the low-voltage circuit, en-



ON-OFF CONTROL of heating and air conditioning equipment is provided by a single-pole single-throw toggle switch on a main panel in the motel office, used in conjunction with a low-voltage heating-cooling thermostat, a double-pole double-throw switch, and a 230/25-v transformer-relay unit.



ELECTRIC HEATERS, each rated at 1000 watts, may be turned off at motel office when guests check out. Air conditioner, just visible in mirror, is mounted in outside wall next to window. Receptacle circuit for conditioner is wired directly to summer-winter switch.



LOW-VOLTAGE THERMOSTAT, mounted within easy reach, may be adjusted by occupant to provide desired degree of heating or cooling. Summer-winter switch and relay unit are located on wall in bath.



ROOM CONTROLS are mounted on bathroom wall. Relay (top) is operated by heating-cooling thermostat in other room; thermostat shown controls only the bath heater, independently of central control. Summer-winter switch is set by occupant.

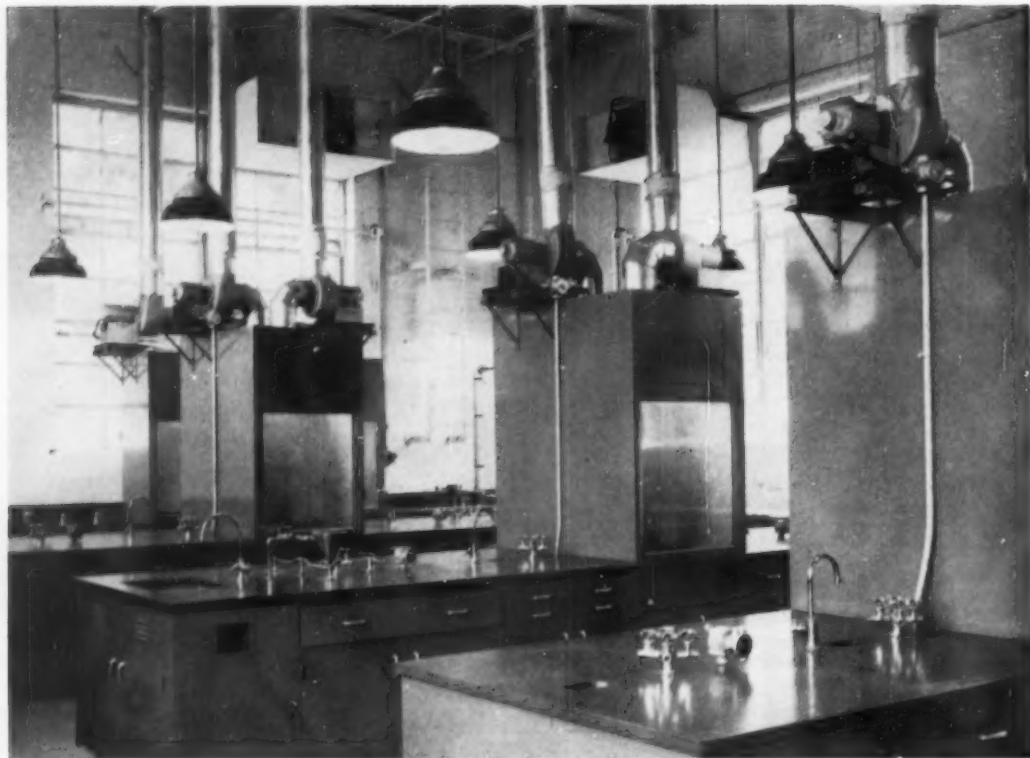
energizing the relay and connecting the line to the air conditioner.

The cooling and heating cycle heaters of the thermostat act to minimize "overshooting" of the temperature by increasing the cycling rate of the thermostat and decreasing the temperature limits between "on" and "off" operation. Mechanical operation of a mercury-

tube thermostat of this type would normally require a room temperature change of about 2 degrees without the cooling and heating cycle heaters, enough of a sweep to be noticed by room occupants. The cooling and heating anticipation feature reduces this differential to the order of $\frac{1}{2}$ degree.

The single-pole toggle switch on

the office control panel breaks the common conductor from the thermostat to the transformer secondary, disconnecting both the heating and cooling circuits. Wiring between thermostat, summer-winter switch, heaters and air conditioners is rated for line voltage; that between thermostats and control panel is low-voltage wiring.



CHEMICAL LABORATORY was considered a Class I Division 1 location, since hazardous concentrations of flammable gases may exist periodically under normal operating conditions. To reduce risks while handling extremely volatile substances, totally enclosed bench hoods were provided with individual exhaust fans.

Jet fuel testing requires

CLASS I DIVISION 1 WIRING

at New York University's new research laboratory

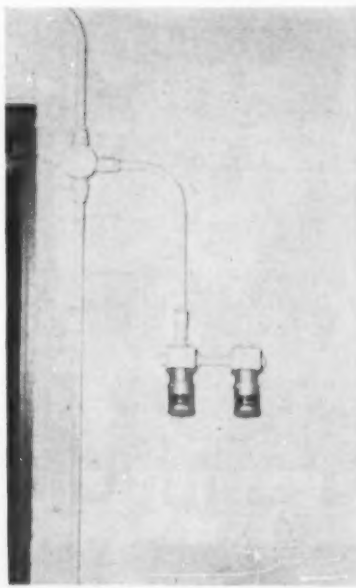
Development and testing facilities plus pilot plant for fuel production demanded full complement of explosion-proof equipment, installed by Davidson Electric Co. of Brooklyn.

NEW YORK University's new research laboratory, a Class I, Division 1 location in the heart of New York City's Bronx, is completely wired with explosion-proof equipment. The building, being in close proximity with extensive residential and commercial areas, literally had the "book" thrown at it, the book being the National Electrical Code. Inspectors checked the installation with a fine tooth comb before issuing the certificate of occupancy.

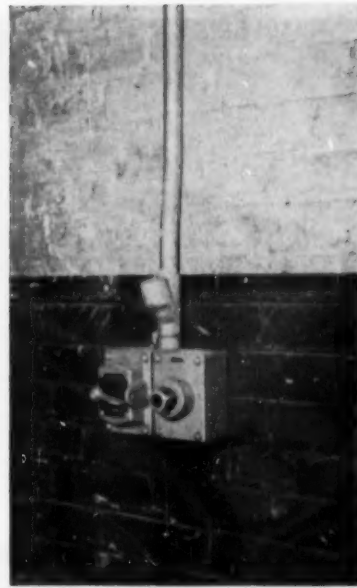
Located in a structure previously used for an electric power generat-



LIGHTING FIXTURES in lab, supported by threaded rigid conduit stems, were provided with flexibility through the use of a Type ESD explosion-proof swivel immediately beneath the ceiling fitting. Locking nut prevents threaded joint at fixture base from loosening. Entire fixture assembly may be removed for cleaning or relamping.



WALL RECEPTACLES are required to be sealed from the remainder of the conduit run. Because the two receptacles shown are less than 18 in. apart, the single type EYSF seal suffices for both. The vertical conduit at the left passes through the wall near the floor and to a panelboard in a non-hazardous area; hence the seal shown is required to prevent gases or vapors from being communicated from the Class I area.



TUMBLER SWITCH with pilot light, mounted in a 2-gang Type EFS explosion-proof housing, controls fan motor of unit space heater in pilot plant. The switch, similar to those used to control lights and fans in the laboratory, requires a seal as shown, since arcs or sparks may be produced. Type EYSF seals were used throughout for vertical conduit runs.

ing station, the facilities are split into two principal functions: a chemical laboratory in which full-time engineers and scientists will conduct research in jet and rocket fuels, and an area in which a plant will be set up for producing developed fuels in quantity. The two sections are separated by a non-hazardous area.

Explosion-proof equipment used includes lighting fixtures, bench and wall receptacles, exhaust fan motors, switches, special distribution junction boxes, and appropriate conduit seals, fittings and accessories.

Twenty 300-watt explosion-proof fixtures provide general lighting for the 1500-sq ft lab. These vented fixtures, pendent-suspended 10 ft above the floor, are hung on rigid conduit stems from explosion-proof swivels. Eighteen fixtures of the same type light the pilot plant area; however due to the extremely high ceiling, the units were hung from messenger cable.

Branch circuit conductors terminate in a Unilet body at the top of the fixture. The remainder of the assembly screws onto the Unilet, electrical connection being

made to the fixture proper by means of a collecting ring. This arrangement makes it possible to detach safely the entire fixture from the conduit body for cleaning or relamping.

A lighting fixture is not normally considered an arc-producing device, hence seals at the fixtures are not demanded by the Code. However, there is a possibility that an attempt may be made to remove a lamp bulb with the current on. Design of the fixture used for this installation is such that five full threads are engaged with the conduit body when actual electrical connection is made or broken. Thus, any sparks or arcs resulting from breaking the current while disassembling the fixture would be completely contained within the fixture.

The "dead-end" type receptacles mounted on the walls of both the pilot plant and lab are disconnected automatically while not in use. When a portable equipment plug is inserted, it must be turned to the right and seated fully before actual re-establishment of the circuit is accomplished. Any arc occurring is thus confined to the combustion

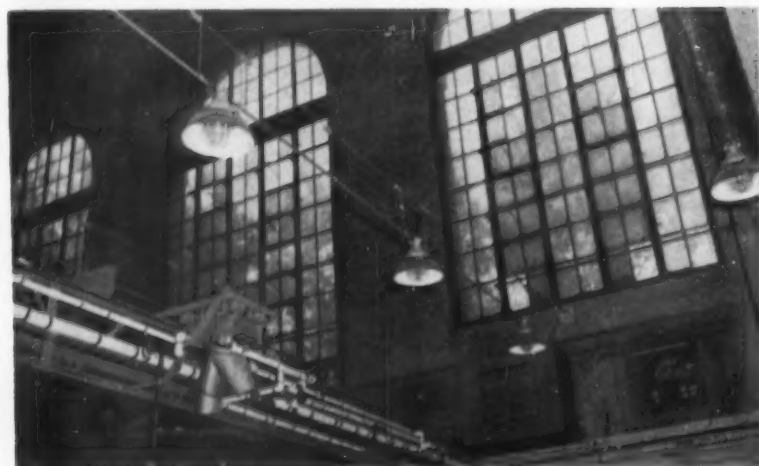
chamber and dissipated. This action also permits use of the plug as a switch—turning the plug without disengaging it from the receptacle disconnects the receptacle contacts from the line. The design also causes the receptacle contact to be broken in case of a sudden jerk on the cord, affording protection against a broken cord and possible arcing. When the plug is completely removed, the receptacle contacts are disconnected; and the hinged lower cap snaps into place. These are 2-wire, 3-pole receptacles, rated 30 amps at 115 volts. The grounding pole is internally connected to the receptacle frame, grounding continuity being maintained throughout the system by means of the metallic components and bonding jumpers where required.

Laboratory bench receptacles, also of the delayed-action type, are 2-wire 3-pole, rated 15 amps at 115 volts. The conduit system feeding these receptacles is completely concealed beneath the benches; home runs were installed on the basement ceiling below the lab.

Fans and lights within the hazardous areas are controlled by 20-amp, 125-volt tumbler switches en-



JUNCTION BOXES in pilot plant area contain distribution blocks for feeding future branch circuits. Type ESUF seals were used in 2½-in. conduit on either side of box. Although not considered arc-producing devices, enclosures or fittings containing taps or terminals require seals if conduit is 2 in. or larger due to heavier currents involved.



PILOT PLANT AREA, with its extremely high ceiling, required special mounting methods. Lighting fixtures were suspended from messenger cable, rigid conduit being run between explosion-proof fittings at base of fixtures. To serve center area of the large room, electrical conduit and junction boxes as well as other utilities were fastened to the structural steel beam spanning the width of the room at its center.



FLEXIBLE CONNECTIONS at motor terminals must be used with approved explosion-proof fittings. Hood exhaust motors used in the lab are considered to be arc-producing devices, requiring sealing. The type used here have terminals sealed where they enter motor frame, hence external seals in conduit are not necessary. Flexible conduit terminates in Type DER explosion-proof junction box.

closed in explosion-proof Condulets and recessed into the bench fronts.

To meet Code sealing requirements, two types of seals were used: Type EYSF for vertical conduits, and Type ESUF for horizontal runs. Fan motors required no external seals, the leads being sealed where they pass through the frame to the terminal housing.

Since exact details and requirements of the pilot plant had not been worked out when the electrical designing was done, provision for future branch circuit wiring within this area was made through the installation of nine explosion-proof junction boxes 18 by 18 by 8 in., each containing four multi-branch distribution blocks. These junction boxes are fed directly by 2/0, 4-wire feeders in 2½-in. conduit. Conductors pass straight through the box, each phase and neutral being skinned and connected to one of the

distribution blocks. Each block has provisions for connecting up to six taps for conductors of sizes No. 8 to No. 4. Bosses built into sides of boxes permit future connections.

This arrangement fulfilled the objective of accomplishing the maximum amount of wiring work under the initial electrical contract. When details of the pilot plant are worked out, motor disconnects and protective devices may be mounted adjacent to the closest explosion-proof junction box with a minimum of conduit to the motors.

Service to the building is by means of four 500MCM conductors through a 400-amp, 3-pole safety switch and 300-amp fuse. Lighting and power feeders originate in an 8-circuit main distribution cabinet. Miscellaneous loads in the laboratory and non-hazardous areas are fed through four 3-phase, 4-wire fused panelboards.



EXTRA NAMEPLATE, indicating that motor has been rewound to Class H specifications, is frequently a guarantee of longer life under unusually severe operating conditions.

MORE FOR YOUR SILICONE DOLLAR

Problems related to high temperatures, moisture, corrosion, chemical attack, overloads, rapid reversing, high starting torques, fluctuating loads, shocks, vibration and dirt can be lessened or licked by switching to Class H insulation.

By J. M. Dillon and J. E. Parker

Carbide and Carbon Chemicals Co., A Division of Union Carbide and Carbon Corp., Texas City, Texas

CONTINUOUS growth of modern industry places constant emphasis upon motor output. More and more motors are being placed in service, and many existing motors are being replaced by larger units. This replacement policy, however, is a costly one—especially if there is no ready application for the old motors. Therefore considerable attention is being focussed upon keeping old units in service, yet increasing their output by employing higher-temperature insulations.

High-temperature Class H insulation has many plus values. For example, existing motors can be rewound to provide greater horsepower, sustain greater overloads and higher temperatures, resist moisture and corrosive atmospheres far better. Use of Class H insulation also permits the selection of a more compact motor where space limitations exist or, if alignment of a present drive unit with a driven machine is fixed, Class H insulation will permit increasing motor output without increasing its physical size.

The three commonly-used classes

of insulation, A, B and H, are respectively limited to hot-spot temperature rises of 65, 90 and 140 degrees C, and their corresponding maximum hot-spot temperatures are limited to 105, 130 and 180 degrees C. This last figure is a conservative one. In fact, U. S. Navy specifications rate Class H insulation, made by the use of silicones, at 200 degrees C. So, by using an insulation that permits higher operating temperatures, it becomes possible to rewind an existing motor to provide greater output, eliminate the cost of a new unit of greater size, and preclude the necessity for realignment of components or rearrangement of equipment.

Horsepower Boosted

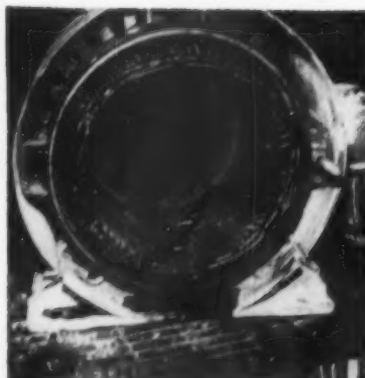
To illustrate these advantages, let us consider the case of a 40-hp Class B motor recently brought into the Houston Armature Works, Texas, for rewinding. Due to overloading and high temperatures, the motor had repeatedly burned out; varnish and insulation having melted to leave conductors ex-

posed, as indicated in the accompanying photo on the next page.

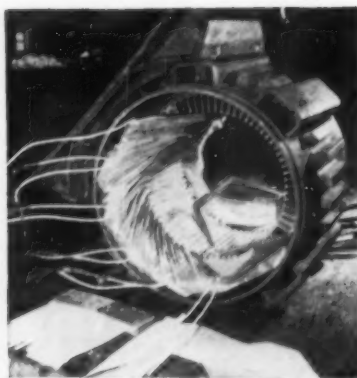
In reconditioning the motor, it was first cleaned, rewound to Class H specifications, then dipped in Union Carbide R-620 silicone varnish and baked. It was then returned to service and, although it was re-subjected to the same overloads and excessive temperatures that existed before, it performed (and is still performing) satisfactorily, uninterrupted service.

As noted previously, permissible temperature differentials between Class B and H insulations are 50 degrees C. Also, based upon test results, it can be stated that insulation life in a motor is approximately cut in half for each 10-degree rise in operating temperature above its maximum rating. Therefore, assuming that the full 50-degree higher temperature ceiling of the Class H insulation was necessary to satisfactorily meet operating conditions in this instance, it can be assumed that the Class B job would have had its lifespan reduced by 97%.

Comparative thermal values of various types of insulation (shown



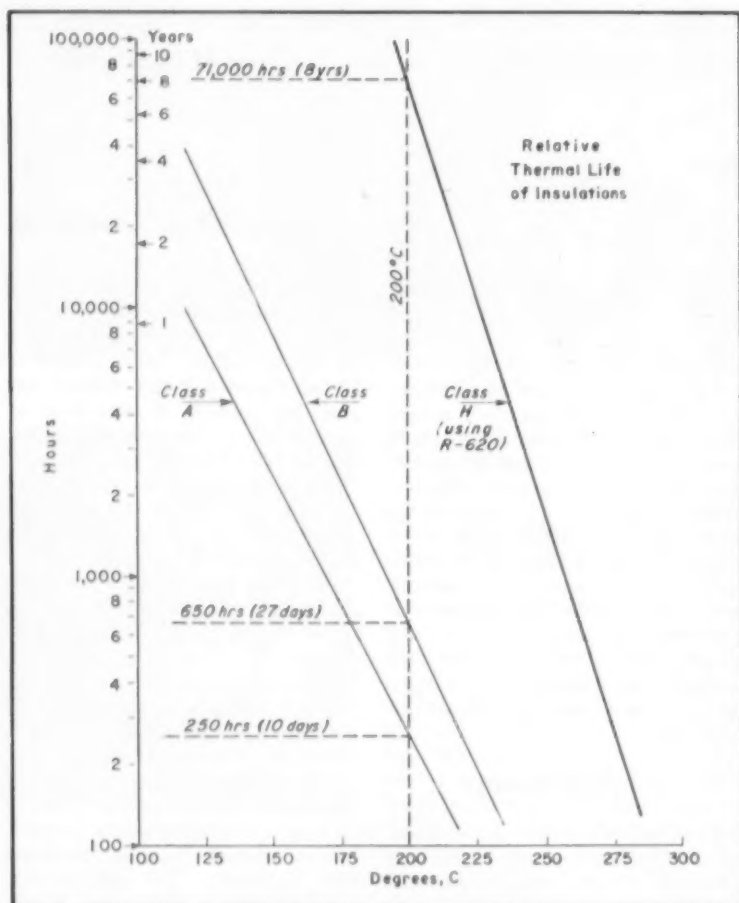
HIGH TEMPERATURES caused this 40-hp Class B motor to fail. Exposed wires can be seen where insulation melted off conductors and ran from the bottom of the stator. Motor, taken to Houston Armature Works in Texas, was . . .



THOROUGHLY CLEANED and wound to Class H specifications. After all the new coils had been installed and terminal connections completed, the motor was dipped in Union Carbide R-620 Silicone Varnish and baked. Motor was then . . .



READY FOR REINSTALLATION and uninterrupted service, with 50 percent increase in horsepower rating. In this instance, rewinding was a thousand dollars cheaper than new unit and it also eliminated revising mounting provisions.



THERMAL LIFE of various types of insulations are indicated in this logarithmic graph. Taking a temperature of 200 degrees C, the life expectancy of Class A insulation would be about 250 hours, or slightly over 10 days; that of Class B would be about 650 hours, or 27 days, while Class H insulation with R-620 Silicone would have a life of about 71,000 hours or more than 8 years of continuous operation.

graphically in the accompanying logarithmic graph) further indicate that, with a temperature of 200 degrees C, the lifespans of Classes A, B and H (R-620) insulating varnishes would be respectively 250, 650 and 71,000 hours or, roughly, 10 days, 27 days and 8 years.

In the actual rewinding case mentioned previously, the 40-hp motor was rewound with Class H insulation for an approximate cost of \$420. Coincidentally, the horsepower rating was raised by about 50%, that is, to about 60-hp.

Assuming that the motor had been replaced by a new totally-enclosed fan-cooled 60-hp motor, the cost would have approximated \$2160 and the salvage value of the old motor might have been as much as \$660.

It can be seen from this that rewinding the existing motor saved over \$1000 (on the motor alone) and it also eliminated the cost of revising the installation to accommodate the dimensions of a larger unit.

This illustrates only one of many ways by which Class H insulation can solve problems and save money. In addition to uprating motor horsepower, high temperature characteristics of silicones also permit satisfactory operation in high ambient temperatures such as those found in positions adjacent to furnaces or blower drives handling high temperature gases, and it likewise provides additional

stamina to permit operation in an atmosphere where dirt and dust tend to obstruct the passage of cooling air, thus causing the motor to overheat.

Another example indicating good high-temperature resistance of silicones recently occurred in another well-known motor repair shop, where six Class H motors were placed in an oven for final bakeout at 450-degrees F prior to closing down the shop for a long holiday weekend. The oven timer was set to shut off power at 5 p.m. the following day (Saturday) but, due to failure of the thermostatic control, the oven was still on Tuesday morning and the temperature recorder has passed the upper limit of 810 degrees.

Fortunately, no fire had resulted, although enough heat had been generated to conduct itself through the oven's aluminum sheet lining, 1/2-in. covering of asbestos board insulation, and completely char the oven's enclosing framework of 2-in. studding. Five hours later the brick exterior of the motor shop was still too hot to touch, yet the six silicone-insulated motors had come through in perfect condition, unharmed but extremely well baked.

Moisture and Corrosion

In addition to the ability to withstand high temperatures, silicones also have a high degree of resistance to moisture which, next to heat, is the biggest enemy of electrical insulations. Whether this moisture is in the form of standing water, mist, or high humidity cooling air, Class H insulation forms an impervious barrier.

Quite frequently motors in outdoor locations are subjected to heavy blowing rains which cause moisture to be picked up by the cooling air and circulated through the motor, appreciably shortening the life of standard insulations, a condition to which silicones are immune.

Flood resistance of Class H insulation has been demonstrated frequently, for numerous cases have been noted where floods have completely submerged motors. Those with conventional insulation generally had to be removed and rewound although, in numerous cases, those insulated with silicones only had to be hosed off to remove mud and other debris.

The third great enemy of electric insulation—corrosion and chemical atmospheres (including acids, hydrocarbons, certain alkalies and solvents, etc.) “raise Cain” with conventional insulations, although silicones are not absorbed or dissolved by these deteriorating substances.

An additional “plus” value of silicone is its simplicity of application; giving bubble free, hard, tough, flexible surfaces and high dielectric values which assure years of satisfactory operation.

As to cost of rewinding a motor with Class H insulation, it will generally average about 50% to 90% more than with conventional insulations. However, since actual rewinding cost is only a small portion of the total repair cost (including motor disconnection and removal, transportation, reassembly, replacement, downtime, etc.), this cost difference becomes relatively insignificant.

Under test conditions, motors wound with Class H R-620 silicone insulation have undergone series of tests, including continuous operation at 240 to 280 degrees C, exposure to 100% humidity, spraying with salt water and oil, and scrubbing the windings with a stiff brush soaked in hydrocarbon solvent cleaner. Even after a stator was dropped to a concrete floor from a height of 3 ft, the flexible R-620 film remained unharmed. At the end of these tests, the motors were battered but were found to be in good operating condition.

Case Histories

I—Let's take a look at several actual case histories from our Texas City plant, where we have over 4000 motors in operation, ranging in sizes from fractional to 700-hp. As one illustration, we greatly increased the capacities of three 75-hp 440-volt motor-driven circulating pumps simply by installing larger impellers, rewinding with Class H insulation, and thereby increasing motor horsepower from 75 to 100. To buy new motors for these pumps would have cost \$14,100 so, by spending \$2,250 for rewinding, a net saving of \$11,850 was realized.

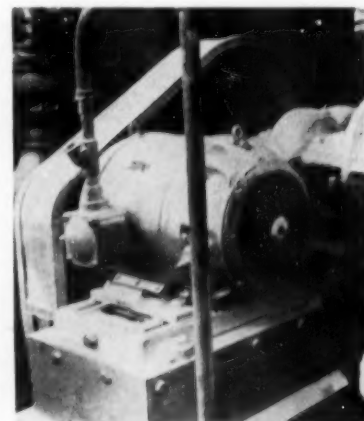
II—In another instance a series of resin grinding mills, driven by 40-hp motors, frequently became overloaded due to wet resin entering and plugging the mills.



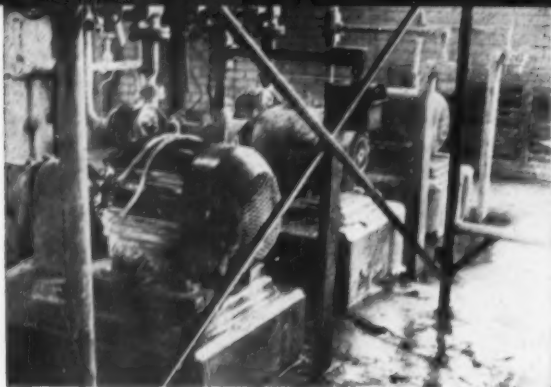
THIS TEST MOTOR, insulated with R-620 silicone, was subjected to 280 degree C, 100 percent humidity, dousing with salt water, oil and chemical solvent, shock and distortion without noticeably decreasing its operating efficiency.



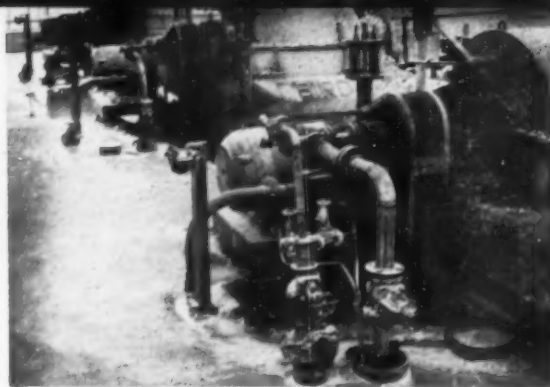
SUPERHEATED STEAM, caused by water in sump pit rising and covering steam pipes in underground distribution tunnel, frequently enveloped this motor. Failures were frequent until Class H insulation was adopted.



CONCENTRATED DUST, drawn into motors operating exhaust fans, partially blocked air passages, acted as thermal insulation, and caused motors to overheat and fail prior to their rewinding with silicone products.



CHEMICAL FUMES, vapor and dripping water can "raise Cain" with conventional insulations, although silicones are not absorbed or dissolved by these various deteriorating substances or agents.



HIGH INERTIA of rotating parts in these centrifuges, plus fluctuating loads, high humidity and frequent spraying and splashing caused severe heating and failure of original windings, prior to rewinding with Class H.

As a result, motor failures occurred on the average of once every two months. Not counting production or down-time losses, direct repair costs amounted to \$700 each. Motors were finally rewound with Class H silicone at a cost of \$500 per motor, as compared with a Class A insulation job of \$300 and, for this additional cost of \$200, yearly savings approximating \$3000 have been made.

III—In one of our process divisions, we have ten 40-hp motor-driven centrifuges installed. Due to high inertia of rotating parts, it formerly took drive motors 3½ minutes to come up to speed. Coupled with fluctuating loads, high humidity and frequent spraying and splashing, this caused severe heating and the original Class A insulated motors failed after three months operation. Motors were then rewound with Class H insulation and have since been operating satisfactorily.

IV—In another case, blowers and exhaust fans were being driven by 30-hp motors located in an area frequently subjected to heavy concentrations of dust. This dust, drawn into motors and deposited in cooling ducts, acted as a thermal barrier and partially blocked air passages, causing motors to overheat and eventually fail. To provide filtered air for cooling would have been economically unfeasible so, instead, motors were rewound with silicone insulation. The dust problem continues and cleaning remains on the infrequent side, yet motors no longer fail in this service.

V—To remove water from an underground steam distribution system, several automatic float-operated sump pumps were installed in enclosed pits. During periods of heavy rain, however, water accumulated in this underground system faster than the pumps could remove it and the

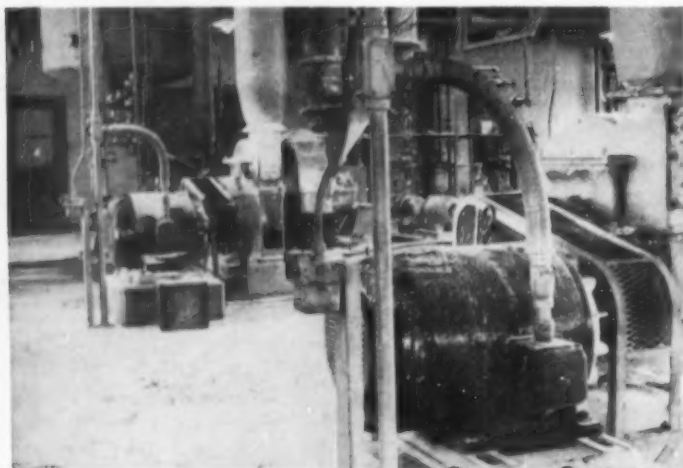
water would rise to come into contact with hot steam lines, causing the water to actually boil. The steam that resulted would completely fill the pits and envelop the motors and, until motors were finally rewound with Class H insulation, motors would fail in a very short time. There are no indications, however, that these periodic steam baths have affected the Class H insulation.

Summary

In review it may be restated that Class H silicone insulation possesses:

1. excellent dielectric properties,
2. resistance to high temperatures,
3. resistance to moisture,
4. resistance to corrosion and chemical atmospheres,
5. long life,
6. resistance to oxidation,
7. stability over wide temperature ranges, and
8. resistance to shock and distortion.

Silicones are not cure-alls but, where high temperatures, moisture, corrosion, chemical attack, overloads, rapid reversing, high starting loads, fluctuating load demands, shock, vibration or dirt are present and cause trouble, it is well to investigate the possibilities for using Class H insulation. Under many severe conditions, this insulation has permitted trouble-free service, greater production, lower maintenance and production costs, more power per unit weight and size, longer life from equipment (10 to 100 times as long), greater operating efficiencies, smaller equipment inventories and greater safety from fires and accidents.



WET RESIN frequently plugged air intake ports of these 40-hp grinding mills, resulting in a motor failure every other month. Rewinding with silicone insulation, at cost of \$500 per motor, saved estimated \$3000 per year.

DATA SHEET

BRANCH CIRCUIT VOLTAGE DROP AND CURRENT CAPACITIES FOR 600-VOLT, TYPE RH CONDUCTORS

VOLTAGE DROP AND CAPACITIES

60 cycle—single-phase, 2 or 3 wires in steel conduit (49°C temp.)
Reference: Standard Handbk. Elect. Engrs.

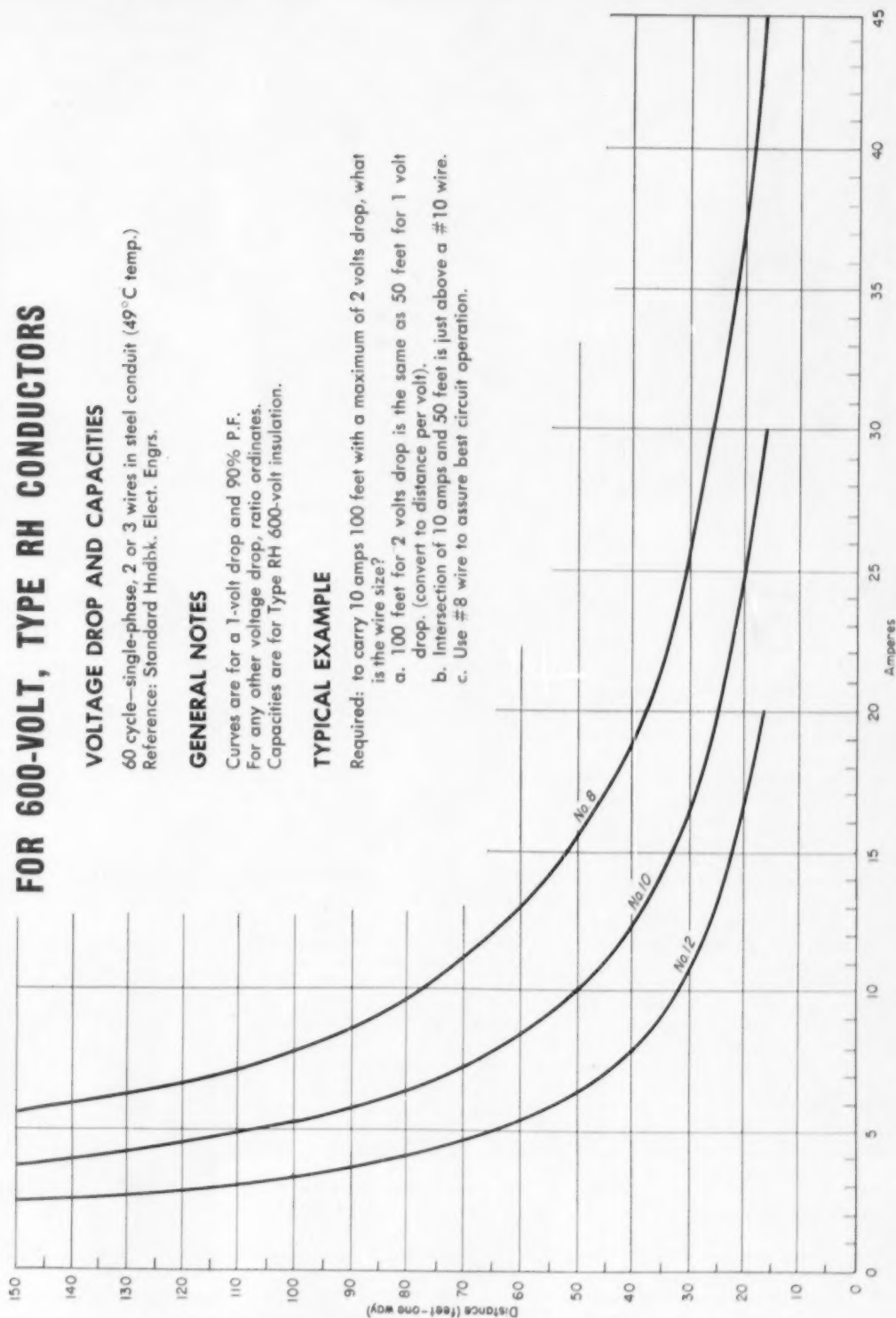
GENERAL NOTES

Curves are for a 1-volt drop and 90% P.F.
For any other voltage drop, ratio ordinates.
Capacities are for Type RH 600-volt insulation.

TYPICAL EXAMPLE

Required: to carry 10 amps 100 feet with a maximum of 2 volts drop, what is the wire size?

- 100 feet for 2 volts drop is the same as 50 feet for 1 volt drop. (convert to distance per volt).
- Intersection of 10 amps and 50 feet is just above a #10 wire.
- Use #8 wire to assure best circuit operation.



Submitted by Daniel M. Kabak, R. R. Popham, Engineer, New York, N. Y.

Practical Methods



HIGH OUTPUT fluorescent rapid-start cool white lamps in luminous indirect luminaires provide excellent quality lighting of 70 fc in this office of Jennings, Engstrand & Henrikson, La Mesa, Calif., sold and installed by La Mesa Electric Co.

800 Ma Lamps Light Office

LIGHTING

A new design luminous indirect luminaire, which houses two 800 ma high output rapid-start fluorescent lamps, has been used to light the office of Jennings, Engstrand & Henrikson, attorneys, in La Mesa, Calif. The installation consists of eight 2-lamp units, which provide 70 footcandles of comfortable and glare-free illumination throughout the 783 sq ft area, which is 27 ft by 29 ft with a 9-ft high ceiling. Cool white lamps are used.

The new luminaires are Smoot-Holman No. PV-288 "Perfect Vision" units, designed specifically to utilize the higher efficiency and greater light output of the 800 ma rapid-start 96T12 slimline lamps. Each luminaire consists of two channels, a ballast housing, two end caps and two rod suspension hangers. The channels are each approximately 3½ in. high by 4½ in. wide, open at top and equipped with a plastic diffusing panel (plastic louver panels are optional) in the bottom. The channels are 8 ft long and each contains one 96T12 lamp. The ballast housing is mounted crosswise between the two chan-

nels, and is of the 2-lamp high power factor series type. The ballast housing and two end caps separate the channels so that the overall width of the unit is 25 in. Suspension hangers are attached to the end fittings and suspend the luminaire 18 in. overall from the ceiling. Thus, the design of the luminaire provides a unique ballast mounting which results in a low operating temperature with longer ballast life and higher light output. Also, the open design of the unit provides minimum obstruction of reflected light from the ceiling.

Total wattage for the eight luminaires is 1920 watts, including ballast load, and the total light output of the 16 lamps is 116,000 lumens. Hence, the coefficient of utilization in this office installation, in which the room surfaces are light in color, is 47%. Maximum brightness of the plastic diffusing panels is about 300 footlamberts, which results in high visual comfort and excellent brightness ratio values.

This installation has been certified under the NEMA Certified Lighting program. It was planned, sold, and installed by a La Mesa Electric Company, La Mesa, Calif. The Commercial Lighting Department of San Diego Gas & Electric Co. cooperated in the design.

Plastic Electrical Tape Saves Harnessing Time

METHOD

A saving of more than 200 man-hours at \$3.12½ per hour was accomplished by electrical contractors Fischbach and Moore, Inc., in harness-binding electrical conductors in a new crushing mill being wired for an Arizona copper crushing plant.

Faced with the necessity of binding a large number of conductors in wiring the mill, the contractor's chief electrical engineer on the project borrowed a trick from the aircraft manufacturers and secured a Scotch brand E-2 taping gun. Using Scotch No. 33 electrical tape, he was able to cut application time to about one-eighth the time required to bundle the conductors with the conventional twine lacing.

The plastic tape method has been used for several years for this purpose in aircraft instrumentation and fire control. Besides cutting down harnessing time, the danger of cutting the conductor insulation—sometimes a problem with twine lacing—is eliminated, and the stretch of the tape makes for a tighter, more flexible binding.

Conductor groups running through cubicles or troughs are bundled on approximately 3- to 4-in. centers with 1½ wraps of tape per binding. On control conductors treed parallel and adjacent to the terminal block, the tape is applied between each conductor branching out to its terminal on approximately 1-in. cen-



CURVED TIP of gun permits tape to be wrapped completely around conductor and cut off in one operation.

take
guesswork
out of
wiring
with
wire



mike

read WIRE, PIPE
or CONDUIT size
at a glance

- pocket size, 4 1/2" closed, 2 ozs. weight
- heavy gauge stainless steel
- inside and outside caliper, calibrated in 32nds
- precision-etched direct reading scales
- pipe size to I. d. conversion table
- genuine leather sheath

Frankly, we never intended to get into the WIRE-MIKE business. Our engineers designed WIRE-MIKE as a labor of love—because they felt such a tool was long overdue. We made several hundred for our friends, and thought we had heard the last of it.

Not so. Before you could say "WIRE-MIKE", we were snowed under with demands for this handy tool. So, although it's a little out of our usual line, we decided to put WIRE-MIKE into production at a nominal price.

A few improvements have made WIRE-MIKE better than ever—and now everyone can have this famous precision lifetime tool for measuring conductor (stranded, solid or ACSR), conduit (rigid or thinwall) and pipe sizes instantly. Only \$1.95 at your Burndy supplier. Burndy—Norwalk, Connect., Toronto, Canada. Factories: New York, California, Toronto. Export: Philips Export Company.



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BURNDY

... FIRST name in electrical connectors; tools; methods



ALUMINUM

OR GALVANIZED STEEL

SUPPORT SYSTEMS

FOR POWER AND CONTROL CABLES

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DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

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HUSKY Service Drawings^{*} cuts down Labor Costs



- We make field erection a simple assembly job.
- We can make take off layouts from drawings furnished by you.
- We eliminate guess work with our service drawings.
- We guarantee our detailed layout on basis of drawings furnished by you.
- **NO OTHER MANUFACTURER OFFERS SUCH SERVICE.**

ONLY HUSKY OFFERS YOU

- ★ Detailed Service Drawings
- ★ Greatest Length
- ★ Fewer Pieces to Handle

Don't

COMPARE
MATERIAL COST

Do

COMPARE
INSTALLED COST

^{*} Small service fee on small jobs.
FREE on large jobs.

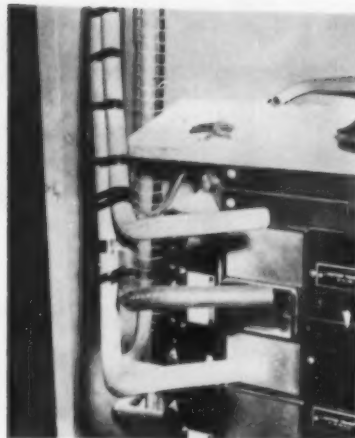
Design and layout assistance available. Unit responsibility assumed. Over 3000 completed installations — Send for free catalog.



AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.

5300 VINE STREET, CINCINNATI 17, OHIO



COMPLETELY TAPED, conductors within enclosure present neat appearance preparatory to being skinned and inserted in breaker terminals.

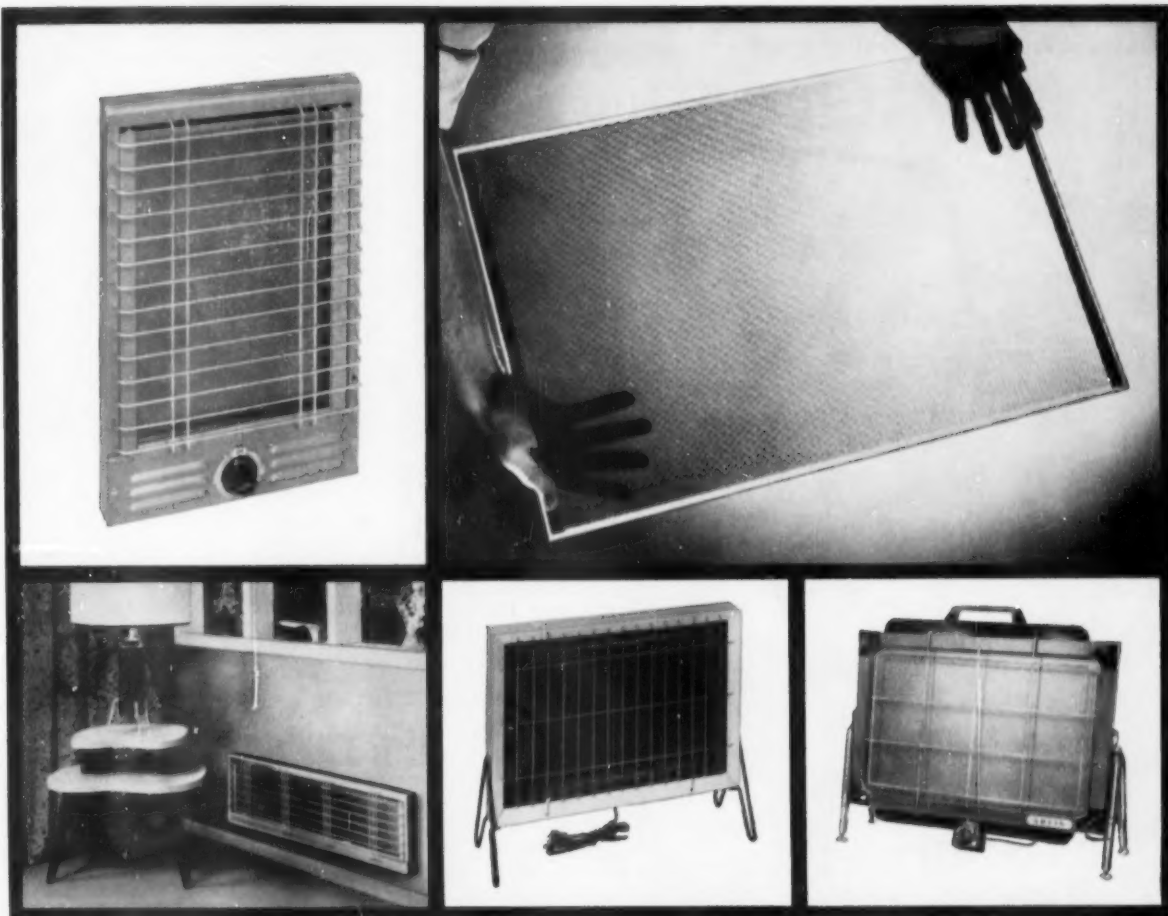
ters. On large conductors (over 1/0), a filament tape (No. 880) is used on 6-in. centers because of its great strength. The overall circumference of the larger conductors, in groups of three, is from 7- to 12-in. with two complete layers used per wrap.

Bundling of the conductors is primarily for appearance; bundles containing 3 to 21 conductors would soon become a tangled mess if not secured in groups.

The gun used weighs less than 20 oz with a 36-yd roll of tape in its magazine, making it possible to bundle wires and cut the tape in a single motion. Tape protruding from the end of the gun is stuck to the wires by the operator's thumb, threaded around the conductors by the gun's curved tip, and finally cut by pressing a thumb-actuated button on the plastic pistol-grip. The end of the cut tape is pressed down to complete the wrap.

When Fischbach and Moore first tested the tape method, a journeyman wireman was timed at 23 minutes lacing approximately 3 lineal feet of conductor with twine. Another operator, using the gun and tape, wrapped an identical length of the same conductor in less than 3 minutes—an 87½% saving in time. Two of the guns were put into use immediately on the project, harnessing all types of conductors.

The copper plant generates its own 25-cycle power at 6600 volts. Brought to the mill facilities by transmission line, the power is stepped down at a substation to an operating voltage of 480 volts, although seven 1000-hp ball mill motors were designed to operate at the full 6600 volts.



PYREX® radiant panels make electric heat economically sound . . . now

New high-output electric space heaters, equipped with PYREX brand radiant panels, are making electric home-heating economically sound now, even in many areas where rates seemed to place it in the future.

Built-ins, and portables for supplementary heating, offer high wattages. This is possible because PYREX panels are of a tempered borosilicate glass that can pack up to 3,000 watts per unit. The need for fewer panels reduces the initial cost of an installation.

Other economies—Because no chimney, ducting or piping is needed, the cost of a PYREX radiant panel installation is equal to, or below that of most conventional heating systems. Utilization of liv-

ing space—formerly earmarked for heating equipment, is also an economic gain.

The PYREX radiant panel carries a history of proven success in many types of portable space heaters, permanent domestic heating systems and in industrial heating and drying applications.

It enables you to offer your customers the comfort, convenience and cleanliness of electric heat plus these other attractive features:

1. **Safety.** No glowing wires or coils.
2. **Fast, uniform heat.** Infrared rays convert to warmth fast. The entire surface of the PYREX panel radiates heat.
3. **Comfort control.** Every room can have the amount of heat it needs right to the degree.
4. **Silence.** No moving parts.
5. **Space saving.** A unit need be only 2 to 3 inches deep.
6. **Economy.** Savings in construction and installation make electrical heating more practical.
7. **Reliability.** The well-known PYREX trademark identifies dependable values.

Now you can get complete heating systems in many designs. And you can install PYREX radiant panel systems in every heating installation with complete assurance of dependable performance.

Write for more detailed information on the characteristics and advantages PYREX panels offer you.

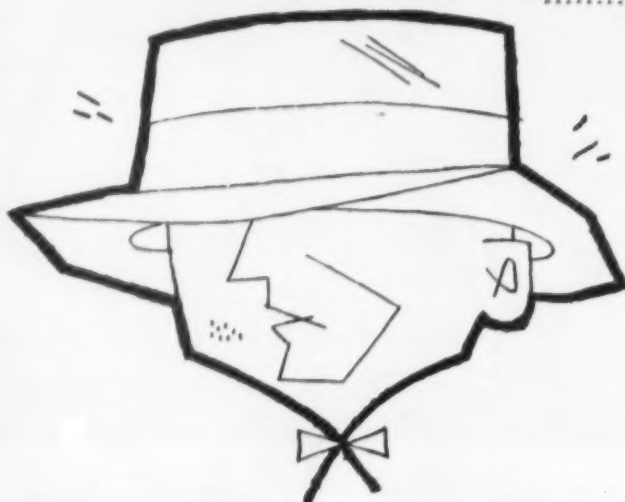
Corning means research in Glass



CORNING GLASS WORKS

40-12 CRYSTAL STREET • CORNING, NEW YORK

YOU WOULDN'T BUY
A HAT THAT'S TOO BIG!



SO WHY BUY A **Control** THAT'S THE WRONG SIZE?

FURNAS
MAGNETIC
CONTROLS
GIVE YOU
CORRECT
CAPACITY
FOR
THE JOB!

The many in-between sizes in the Furnas Electric starter line let you select the motor control that is best suited for your particular requirements—with no wasted capacity and expense. By matching the starter to the job you can *save up to 25%*. For proof, we invite your comparison of the Furnas Electric line of starters consisting of 9 sizes with the 5 sizes normally offered.

And you can *save up to 40%* in space by securing the correct size starters for the job, Furnas Electric produces more stock sizes of starters in the 1-100 hp range than other control manufacturers.



SERIES YD
SIZE 1



SERIES YE
SIZE 1 1/4



SERIES YF
SIZE 2

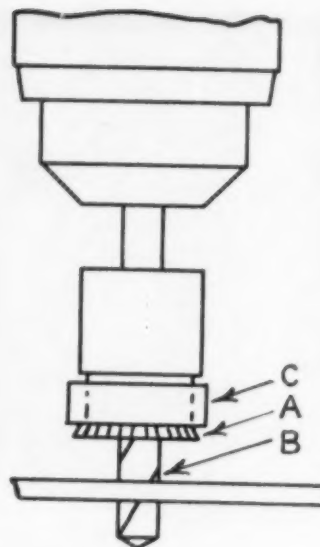
A15



FURNAS ELECTRIC COMPANY
BATAVIA ILLINOIS

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

WRITE FOR BULLETIN 5530—1067 MCKEE STREET, BATAVIA, ILLINOIS



Combined Drilling-Cleaning Tool for Ground Connections

METHOD

Drilling of metal equipment, framing, etc. to provide the spot for a good electrical connection to ground is often necessary after the particular item has been painted, plated or otherwise chemically treated.

The drilling and removal of the surface substance to bare metal can be accomplished effectively in one operation by the use of the combined drilling and cleaning tool shown in the illustration.

The stem is removed from a small end-working wire brush (A) and a hole drilled axially through it to accommodate the twist drill (B). The metal casing of the wire brush is then brazed or silver-soldered to the drill shank. To stiffen the bristles of the brush, a strong rubber ring (C) is pressed over them, leaving only about 1/8 in. of exposed bristle ends protruding beneath the ring.

The hole is drilled in a normal manner using a drill press or portable tool. When the drill pierces the metal, the brush end is pressed into the surface, exposing bare metal in just a few revolutions.





Circuit breaker making an important decision

This is a Heinemann hydraulic-magnetic circuit breaker in operation.

It is remarkable for its ability to sort out dangerous current overloads and short circuits from starting inrush and other harmless, momentary overload conditions. It makes an unfailing decision and, accordingly, opens the circuit or keeps power flowing.

The decision it will make is an important one, for upon it depends the life of costly electrical equipment and wiring. A wrong decision to open the circuit could result in needless service interruption... inconvenience, waste in man-hours and production time. In wrongly deciding *not* to break the circuit, it could cause motor burnout, damage to electronic equipment or transformers, wiring deterioration.

WHY ALWAYS THE RIGHT DECISION?

The Heinemann Circuit Breaker always makes the right decision... a decision that is never influenced by surrounding temperatures... because its hydraulic-magnetic operating principle is based on power, not heat. (And for this reason Heinemann Circuit Breakers always carry full rated current, never require de-rating.)

TIME DELAY FOR OVERLOADS... INSTANTANEOUS SHORT CIRCUIT PROTECTION

The Heinemann Circuit Breaker responds with inversely proportioned time delay to overloads, eliminating nuisance stoppages. Time delay is matched directly to the characteristics of the circuit or equipment to be protected.

At 10 times its rated current, it trips instantly... even before the sudden burden on the line can nudge an ammeter needle... providing the fastest, surest protection available.

The decision you make in specifying a circuit breaker is important, too. That's why more designers have turned to Heinemann for the logical solution to circuit protection problems.

Send for your copy of Manual 101, "WHAT YOU SHOULD KNOW ABOUT CIRCUIT BREAKERS."



HEINEMANN

ELECTRIC COMPANY

132 Plum St., Trenton 2, N. J.

Circuit breakers

2 NEW PRODUCTS in the KLEIN LINE

PUMP PLIER

Catalog No.
510

Length
9 1/2 in.



ADJUSTABLE WRENCH

Catalog No.	Length
500-6	6 in.
500-8	8 in.
500-10	10 in.
500-12	12 in.

These new high-quality tools have been added to the Klein line.

A Pump Plier that gives easy one-hand operation and a firm grip in any of four positions.

And the new Klein Adjustable Wrenches of drop-forged alloy steel, light in weight, chrome plated for lasting protection and service.



Write for Bulletin

Bulletin No. 1157 on these two Klein tools is now available. Send for your copy.

Mathias KLEIN & Sons
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100 Footcandles in Men's Store

LIGHTING

Customers in the Ripley Clothes menswear store, in Brooklyn, N. Y., have no seeing problems as they examine the merchandise. Instead, they have 105 footcandles of well-diffused uniform intensity of light throughout the 3150 sq ft sales area, free from glare and shadows. Merchandise can be seen quickly and easily, either on display or when viewed for close inspection.

Illumination is provided by a wall-to-wall rigid vinyl plastic luminous ceiling. The entire ceiling is 35 ft wide by 90 ft long, and 10

ft from the floor. Housed in the plenum above the plastic ceiling are continuous rows of 8-ft cool white slimline lamps, running lengthwise of the store on the cavity ceiling, and spaced on 24-in. centers. Easy-to-install lightweight extruded aluminum rails with Alumilite finish support the corrugated diffusing plastic. The luminous ceiling and all supporting members, wiring strips, etc. were supplied by Lumin-Glo Ceiling Corp., Bellmore, L. I. and were specified by Robert Piesman, Ripley's design and construction engineer.



OVER 100 FOOTCANDLES are diffused throughout the main menswear sales area of Ripley's Clothes, Brooklyn, to make shopping comfortable and pleasant.



The most beautiful money in the world...
is made for you by Honeylite!



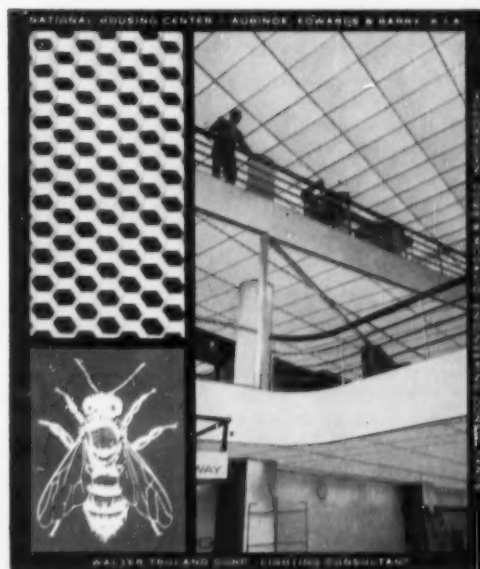
HONEYLITE combines maximum efficiency with maximum beauty.
HONEYLITE is easier to install.
HONEYLITE is suitable for every application. UL approved.

Used in full ceiling lighting, in recessed troffers and in all types of lighting fixtures, HONEYLITE transmits the most light with the lowest surface brightness.

HONEYLITE may be used in all types of T-bar suspension systems. Because of its low weight (2 oz. per sq. ft.) and inherent acoustical properties, HONEYLITE requires a far less complicated suspension system than any other light diffusing material.

HONEYLITE can be incorporated in any lighting installation — suspended louvered ceilings, troffer diffusers, industrial and commercial fixtures.

For price lists and detailed information see your local distributor or write to Dept. EC, Hexcel Products, Inc., 951-61st Street, Oakland 8, California.



HONEYLITE*

LIGHT-DIFFUSING ALUMINUM HONEYCOMB

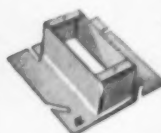
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It is also our business to keep daily pace with the contractor's complex wiring problems. The result is our modern line, geared to your current needs. For example:

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Partitions
For 4" and
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Sq. Boxes

In modern building methods, Arrow Tile Covers are ideal for brick, tile and cinder block construction. They are widely regarded as the most practical and economical devices for electrical installations.

Available in standard 1½" and 2" raised sizes for 1 and 2 devices. Also raised sizes from ¼" to 1¼".

Depend on all Arrow products for premium quality; for greater time and cost economies. Specify "Arrow Conduit" in your next job order.



FREE!

WALL CHART—Box guide for maximum number of conductors. Quickly identifies boxes & covers.

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Luminous Area Lighting for Bank

LIGHTING

Circular luminous Visionaires offer pleasant contrast to the rectangular "large area" luminaires used in lighting the new Wilshire-Catalina branch of the Citizens National Trust and Savings Bank of Los Angeles. The circular treatment of the lighting unit provides effective relief from the austerity of uninterrupted line and adds dramatic interest and definition to the public or customer area.

The matte finish of the Plexiglas eliminates reflected glare and provides unusual low brightness, permitting greater visual comfort. The all-metal rectangular louver-shielded units are recessed in two sweeping parallels 11 feet apart over the banking area, terminating in right angles to form a double frame for the circular units. A high general maintained intensity of 60 fc is achieved.

Douglas Uses 450 Footcandles

LIGHTING

A lighting installation of 450 footcandles maintained in service makes seeing easy for the employees in the electrical bench assembly area of the Douglas Aircraft plant in Torrance, Calif. The work in this area is highly exacting, consisting of assembly of many sub-

miniature parts, and the high-level lighting has proved to be highly desirable, most satisfactory, and fully justified.

This pacesetting high intensity lighting system consists of six rows of 4-lamp 8-ft louvered reflectors, seven units per row. Lamps are



A NEW HIGH in illumination quality and quantity has been set for employees at Douglas Aircraft plant in Torrance, Calif., where 4-lamp continuous row louvered units installed 5 ft above assembly benches, using 800-ma G.E. rapid start lamps, provide an average of 450 footcandles throughout entire area.

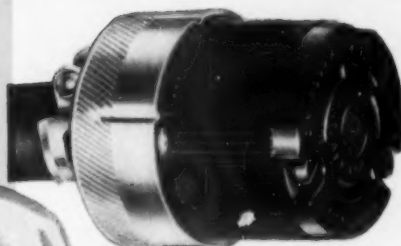


Cuts wiring time 1/3!

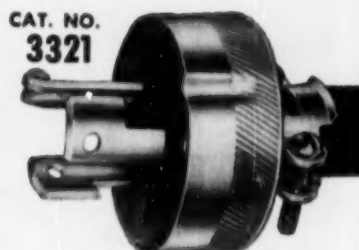
NEW, SUPER

Twist-Lock[®]

SERIES 3000



CAT. NO.
3323

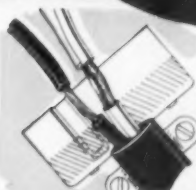


CAT. NO.
3321

ONE out of every **THREE** valuable wiring seconds **SAVED**, thanks to Hubbell's new screwless **PRESSURE-GRIP** terminals. This exclusive cost-saving and labor-saving idea completely eliminates the conventional "wrap around—screw down" binding post method. Wire ends are simply pressed into their individual pockets and are locked securely when the dead front section is positioned. Tests prove it's the safest, most secure, most fool-proof connection there is. Remember, it **PAYS** to have **GOOD CONNECTIONS**. Hubbell connections, that is.

Write for folder

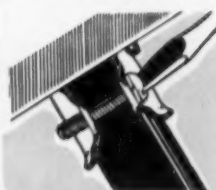
*Completely Wired
in 6 easy steps*



1. Use knurled section on shell as strip gage. Insulation left on wire ends can simplify insertion by containing strands.



2. Spread cord clamps and insert conductors into holes making sure green (ground) conductor enters hole marked GR.



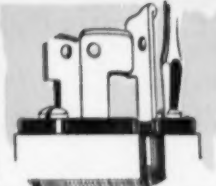
3. With cord pressed in firmly, tighten cord clamps to maintain position.



4. Judge approximate wire length and snip off excess.



5. Bend each conductor outward into its individual pocket and press firmly into place.



6. Insert dead front into keyed shell and engage the two sections securely by tightening each screw alternately until all are firmly seated.

Harvey Hubbell, INC.

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RED-D-PRENE

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**DIAMOND
TYPE
MD***

*Mill Duty

*Portable Cords in
Industrial Red minimizes
accidents...cuts maintenance costs!*



No flat sides, no off center conditions. Gives maximum flexibility, is moisture resistant.



Industrial Red sheath provides maximum visibility for absolute identification.

For positive identification — in your stockroom or inside and outside the plant by maintenance men—Type MD RED-D-PRENE is your safe choice! First designed with a tough, oil-resistant Neoprene sheath (in Industrial Red). Assures long wear, materially reduces maintenance costs. Carries current where you want it, safely and at lower cost. Outstanding for heavy duty use in Mill and Plant installations.

*Without delay : : : write for our new
descriptive brochure and samples!*



DIAMOND WIRE & CABLE CO.
SYCAMORE, ILLINOIS

F96T12/RS cool white type, operated at 800 ma. Louvers have a 35-degree cutoff. Units are installed 5 ft above the working plane.

In addition to the 4-lamp units, ceiling units using 96T12/CW lamps operated at 430 ma are surface-installed on the ceiling between beams, to provide about 100 footcandles of general diffuse illumination, which helps to reduce the brightness contrast between the work and the general overhead area surfaces.

The generally higher levels of illumination outdoors in California are credited with influencing the trend to higher levels of lighting indoors, with intensities of 150 to 200 footcandles becoming more and more common. But now, with this 450-footcandle installation throughout an entire department area, a new high in interior lighting levels has been set, with inherent color and comfort quality.

The workers have high praise for this new lighting system. The improved seeing comfort has helped to reduce rejects to a minimum, has improved worker morale and efficiency, reduced eye fatigue and worker tension, and resulted in an exceptional improvement in work turned out. These results more than justify the investment, according to Douglas management.



VERTICAL ALIGNMENT of branch conduit runs and wall boxes for receptacles, switches and power outlets was obtained during the installation period at No. 3 Penn Center, Philadelphia, through the consistent use of plumb bobs. With bob cords attached to the face of a box, and with a conduit containing a precise-dimensioned offset accurately formed with the use of templates and jigs, the conduit could be bent and adjusted at the local installation point until the bob came to rest over the desired point on the final wall line. Contractor performing the electrical work was Harry F. Ortlip.



Wagner Unit Substation Transformers supply power for new IBM plant...

IBM's new Kingston Military Products Division plant at Kingston, New York, utilizes modern load centers for in-plant electrical distribution. The unit substations in this load center system bring power at high primary voltages close to the load to reduce voltage drop and conductor losses.

The 1000 kva unit substation, shown above, delivers 480 volt three phase power to large machines and equipment. Another 500 kva double-ended substation supplies 208Y/120 three phase power for lighting and small power loads.

These unit substations are equipped with Wagner dry-type Transformers because Wagner transformers are carefully engineered to meet heavy industrial demands—are built to stand up under rigorous 24 hour a day production schedules.

Wagner Unit Substation Transformers are "Predesigned". They are built in standard ratings which are coordinated with the specifications of unit substation builders. This completely eliminates individual job engineering—saves time—reduces costs. You get a proven design in a completely assembled and tested transformer—and get quick delivery.

Consult the nearest of our 32 branch offices or write for Bulletins TU-205 and TU-214. They give full information on Wagner Unit Substation transformers for industrial power distribution systems.



IBM's new Kingston Military Products Division plant.



Wagner Electric Corporation

6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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T56-9

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

TRADE **ARRO MARK**

spiral-drive

NAIL ANCHOR

For All Masonry (RUST PROOFED)

DRILL HOLE
Same diameter as anchor. Depth should be length of anchor less thickness of fixture.

INSERT ANCHOR
Through fixture and tap it into masonry flush against the fixture.

PLACE NAIL
Into anchor and hammer nail until fully inserted.

The fully inserted nail will expand the anchor and fasten the fixture firmly and neatly to the masonry.

13 SIZES AVAILABLE
Diameter and Length
from $\frac{1}{8}$ " x $\frac{1}{2}$ "
thru $\frac{1}{2}$ " x $3\frac{1}{2}$ "

TRADE **ARRO MARK**

See your industrial, hardware or electrical supplier
ARRO EXPANSION BOLT COMPANY
 1540 Boone Ave., Marien, Ohio

WHAT'S THE LAW?

By Jack and Michael Strauss

QUESTION: Does "electrical work" include moving radiators?

Mr. Kant, an electrical contractor, was hired to do electrical work in a building that was being renovated. During the course of the job, he detailed McGirk, one of his electricians, to do some wiring.

As it developed, McGirk had to be a Hercules in addition to an electrician to get his assigned work done. Heavy radiators were in his way and he had to move them. Unfortunately, while shifting one radiator from one side of a room to another, it slipped from his grasp and landed on his big toe. Soon, McGirk's toe swelled to absurd proportions.

Unable to work because of his injury, McGirk requested a Workmen's Compensation award from his employer's insurance carrier. He was turned down.

"The coverage of our policy is for 'electrical wiring—within buildings—including installing and repairing fixtures'", a representative of the carrier explained to the electrician. "You weren't hurt while doing electrical work. You were injured moving a radiator. Therefore, your injury wasn't covered by our policy."

"That's absurd," was McGirk's answer. "Moving that radiator was part of my electrical work. If I didn't move it, I couldn't have done the wiring."

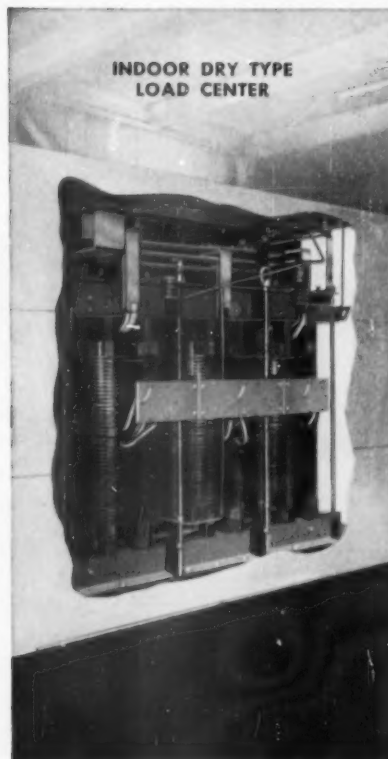
Intent upon collecting an award, the electrician took the matter to court.

THIS WAS THE DECISION: The Court held for McGirk. It ruled, in effect, that work performed by an electrician to enable him to perform his electrical job is part of his electrical work. Therefore, concluded the court, since removing the radiator was necessary before McGirk could pursue his work as an electrician, his injury was covered by the policy and he was entitled to an award.

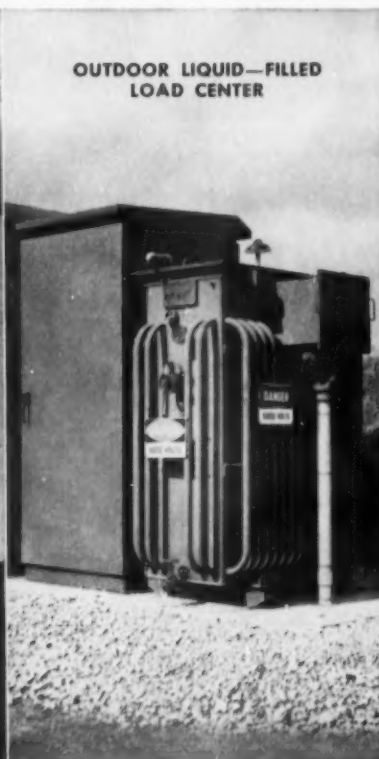
(Based upon a 1950 New Jersey Decision. State laws vary. For personal guidance, see your local attorney.)



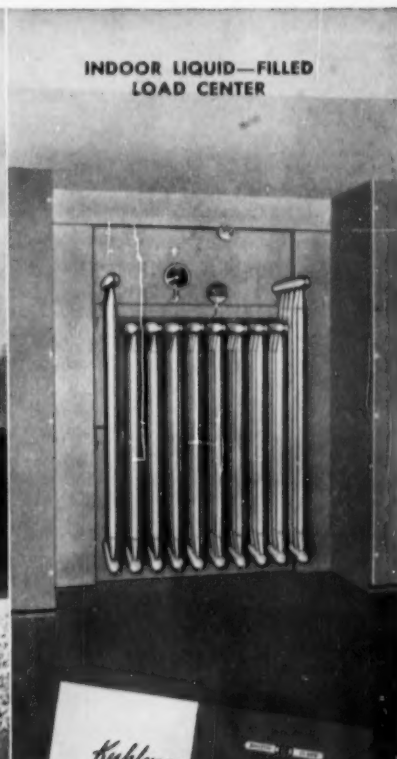
NEW BULLETIN ON LOAD CENTERS SHOWS 3 WAYS TO REDUCE POWER LOSSES AND LINE DROP



INDOOR DRY TYPE
LOAD CENTER



OUTDOOR LIQUID—FILLED
LOAD CENTER



INDOOR LIQUID—FILLED
LOAD CENTER

Now you can get complete technical information on Kuhlman's three basic load center designs. For both indoor and outdoor service, they are ideal for all types of industries, commercial buildings or special job requirements. Compact, safe, modern—they can be installed near the center of the load. Thus, long secondary runs are eliminated and power losses reduced. This improves voltage regulation . . . increases lighting efficiency . . . makes motors easier to start.

Choose the Kuhlman load centers that fit your needs. Standard components provide numerous circuit combinations for either indoor or outdoor installations. This new Kuhlman reference bulletin, CS-1000, will give you all the facts. Get your copy—simply send the coupon below.



KUHLMAN

ELECTRIC COMPANY

5614

KUHLMAN ELECTRIC CO.—1001 26th St.—Bay City, Mich.

Gentlemen: Please send me the new bulletin, CS-1000, on Kuhlman Load Center Transformers.

Name _____
 Title _____
 Company _____
 Address _____
 City _____ Zone _____ State _____

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA



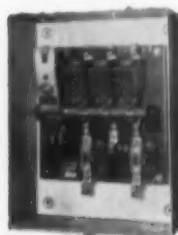
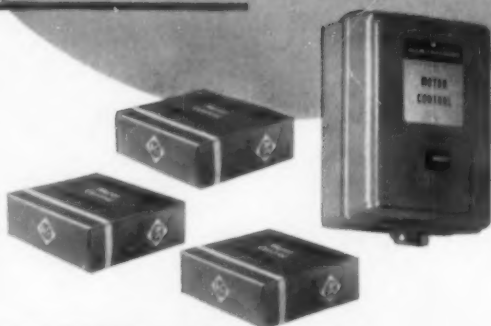
a Complete

Line

SIZE 0-3 STARTERS

Converta-Kits Permit Easy Modification of Basic Starter

You get MORE . . . more flexibility with Allis-Chalmers control. A screwdriver and the proper *Converta-Kit* are all you need to change a basic Allis-Chalmers size 0-3 starter into the exact unit demanded by your production. *Converta-Kits* are available for push-button, selector switch and electrical interlock modifications. Starter replacement parts—contacts, magnetic coils and overload relays—are also available in packaged kits.



1. Arc across contacts as they start to open.
2. Strong blowout action forces arc to center.
3. Contacts fully open — arc extinguished.

NEW LINE OF SIZE 4-5-6 STARTERS

Quick Quenching Extends Contact and Chute Life

Heart of these starters is a new contactor which uses a revolutionary principle of arc interruption. In centering the arc, increased blowout action and fast quenching result from a combination of thermal convection and magnetic action. Since the arcing time is sharply curtailed, contact and chute life are greatly extended.



HIGH VOLTAGE STARTERS

Complete "Line-to-Load" Control and Protection

Allis-Chalmers Type H starters are built in a wide range of ratings for squirrel-cage, wound-rotor and synchronous motors . . . for full or reduced voltage — reversing or non-reversing — with plugging, dynamic braking and multi-speed features. Built into the starter is the type and degree of protection dictated by the application.

What is your control problem?

As manufacturers of a diversified line of industrial equipment, Allis-Chalmers has solved thousands of control application problems. This specialized experience is yours when you specify Allis-Chalmers control. See your Allis-Chalmers representative or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Converta-Kit is an Allis-Chalmers trademark.



ALLIS-CHALMERS

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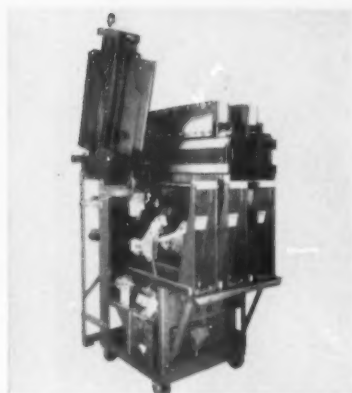
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Product News



Circuit Breakers (1)

For 13.8 kv, 1200- and 2000-amp applications, new power circuit breakers, designated 15HV-750, are now available with interrupting rating of 750 MVA. These breakers, with their larger capacity, require no increase in stationary structure dimensions over those for 15 HV circuit breakers rated 500 MVA interrupting. Added to the established line for 4.16 kv applications, are circuit breakers, designated 5HV-350, having not only the higher interrupting rating of 350 MVA but with continuous current rating of 3000 amps for mains and bus ties or of 1200 amps for feeders. The 1200-amp, 5HV-350 stationary structure is 26 in. wide; the 3000-amp, 5HV-350 is 36 in. wide; both are 90 in. high and of depth matching other 5 HV switchgear. Also for 4.16 kv, 1200-amp applications, circuit breakers, designated 5HV-75 with the higher interrupting rating of 75 MVA, are available and are interchangeable in stationary structures with present units rated 50 MVA interrupting.

I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.



Truck Body (2)

A new service body, Model UB, has been added to this line of service and construction bodies. Special features are 15-in. compartments with shelves and trays to hold tools and a 4-ft wide bed with a die-formed, heavy-duty plate floor. Double panel doors are hinged to the body on free-moving bearings. Flush, pullout type door,

handles with slam-action catches and master-keyed cylinder locks are used. Exterior surface is acid-etched to clean and protect metal, then primed with a non-flaking primer to prevent rust. Entire underside is covered with underseal. Optional equipment includes side or overhead ladder racks; telescopic steel cover with end-gate enclosure to close off bed; removable pipe vise bracket with front support; rear bumper with safety-tread step and pipe carrier with tension clamps.

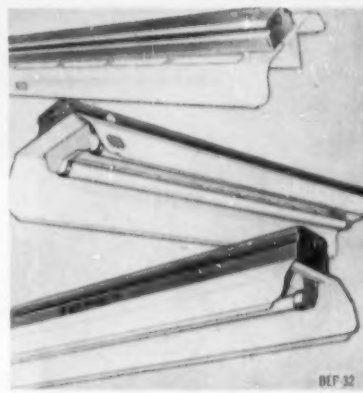
Utility Body Company, Oakland, Calif.



Transformer (3)

A constant wattage mercury vapor lamp transformer for outdoor operation of two H1 400-watt lamps. Features are line current surge during starting period limited to effectively no more than normal, full load value; regulated lamp wattage and light output; open-circuit protection; no lamp outages in face of severe line voltage dips, and elimination of primary taps. The 2-lamp transformer, designed for reliable starting and operation in temperatures down to minus 30°F, is available for outdoor commercial and industrial applications. An impregnated core-and-coil assembly, along with capacitor and resistor units, is supported and compounded. Case cover is riveted and solder-sealed to body. Three boss feet on one end of case provide for mounting at pole base or in any compartment or vault. At other end, a threaded connection bushing is suited to taping to cable or connection to conduit. Overall transformer case height, including threaded bushing connection, is approximately 13 1/4 in.; case diameter is 9 1/4 in. Bulletin MV-244 is available.

Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill.



Lighting Systems (4)

Three new fluorescent industrial lighting systems are now available. They include (1) RLM Twin-Flo SD-1, semi-direct equipment with 25% upward light; (2) RLM equipment for 60-in., 90-100-watt, T-17 preheat lamps and (3) equipment for 48- and 96-in., 800 ma. high output rapid-start lamps. All channel-sections are of heavy gauge steel, assuring accurate alignment in continuous line installations. All reflectors are of heavy gauge enameling iron finished in "life-time" porcelain enamel. Reflecting surfaces have a reflection factor of 85% or more to assure maximum light output.

Benjamin Electric Mfg. Co., Des Plaines, Ill.



Potheads (5)

Type "ATA" potheads, 26-kv, for 200 lbs per square inch oil or gas filled pipe type cables are now made in three-conductor style for generator cable terminations. The spreader head body part is welded non-magnetic stainless steel. No castings are used in contact with high pressure oil or gas.

G & W Electric Specialty Company, 7780 Dante Ave., Chicago 19, Ill.



midwest

A Midwest quality fitting. "Quality" is just a condensed way of saying: "Getting the total job done -- right -- with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations, is our objective at Midwest.

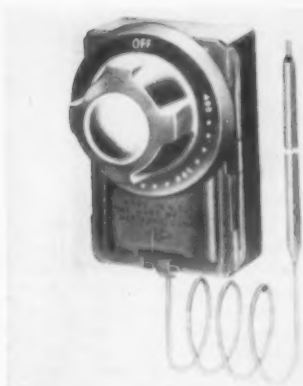


Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

Chicago 12, Illinois



Thermostats (6)

A new series of "Diamond H" thermostats for range, oven, industrial and air conditioning applications. The line, designated Series 270, includes a wide range of models. Oven thermostats have UL approved ratings of 25-amp, 120-240-volt, ac only, and a standard temperature range of 200° to 500° with other ranges available to meet special requirements. They include 2- and 3-position units, as well as single dial units both with or without automatic preheat operation. Some models are equipped with terminal clips for direct connection of neon pilot lights to the thermostat; others may be equipped with auxiliary terminals for connection to remote pilot lights. Industrial models are designed for such applications as laboratory equipment, platens, steam tables, oil baths, grease kettles, coffee urns, blue print machines, etc. Bulletins T270 and T276 are available.

Hart Manufacturing Co., Hartford, Conn.



Capacitors (7)

New 10-kvar, single-phase, 240-volt capacitors designed for power factor correction on secondary distribution circuits, meet all NEMA standards. They have an overall height of 29 1/8 in. and a diameter of 5 in. The line includes four units—3, 5, 7 1/2 and 10 kvar. All units offer the same fea-

tures: solder-sealed bushings, two 48-in. insulated leads, and steel tanks protected from corrosion by L-M's aluminum metalized finish and an alkyd-resin paint. Terminal-mounted fuses, integral to leads, are available when required. Units can be mounted with bushings up or down. A 2-hole bracket is furnished for direct pole mounting, or an EEL-NEMA bracket is provided for crossarm mounting.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.



Rotary Hammer (8)

New portable electric rotary hammer which uses shock waves to drill. Creating over 36,000 shock waves a minute, it cuts a clean, true hole up to 40 ft in depth through stone, rock or reinforced concrete. It weighs approximately 10 lbs. It can be used for overhead or horizontal work. Designed for drilling 1/8-in. up to 1 1/4-in. diameter in concrete or masonry for steel pipes, slug-ins and electrical installations. It is powered by a Thor-built electric motor which operates on 115-volt ac or dc at 100 rpm.

Demo-Haines Tool Corp., North 10th Machine Works, Enid, Okla.

Electric Heater (9)

A new portable model of radiant circulating electric heater, with the same Tri-Core heating element. Heat is radiated directly into the room from the two forward sides of Tri-Core, and high polished reflector is designed so as to circulate heat radiated from the third side, resulting in even warm air circulation throughout the entire room. It is light weight, making it easy to carry from room to room. Unit is made in capacities for big rooms and small rooms and is automatically controlled by built-in thermostat. Grille shields the heating element and provides protection. It is removable for cleaning. Enclosed connection box with terminal block shields all electrical connections. Literature is available.

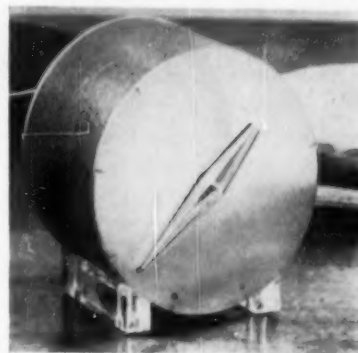
Electromode Division of Commercial Controls Corp., Rochester 3, N. Y.



Floodlight (10)

A new floodlight, known as Wide-Lite, is designed for the utilization of the new color-improved fluorescent mercury vapor lamps. Weatherproof 400-watt floodlights meet most outdoor requirements for broad area lighting with maximum operating economy. They come with type "B" reflector designed for extra depth as well as breadth of beam. Type "A" reflector, giving broader, less concentrated beam, is also available. 1000-watt "Big Bertha" weatherproof Wide-Lite is for use with the new 1000-watt color-corrected mercury vapor lamp or 1500-watt inside frosted incandescent lamp. Aisle and area Wide-Lites are for indoor use in aisles, bins, assembly lines, work areas.

Wilson Electrical Equipment Co., Houston, Texas.



Lamp Control (11)

A new dimming device, called Luxtrol lamp control, makes it possible to dial the amount of light you want from any lamp. Control rests on table next to lamp and is plugged into any convenient outlet. One or two lamps can be connected to the Luxtrol plug at the outlet. A pointed dial rotates at finger touch. It can be reversed to lower light intensity from lamp. Models in gold and silvery rhodium are available with coverings of textural Japanese grass cloth or simulated leather. Each lamp control is rated at 125 watts.

Superior Electric Co., Bristol, Conn.

Change these Two Rings and You Convert

This **NEW Revere**

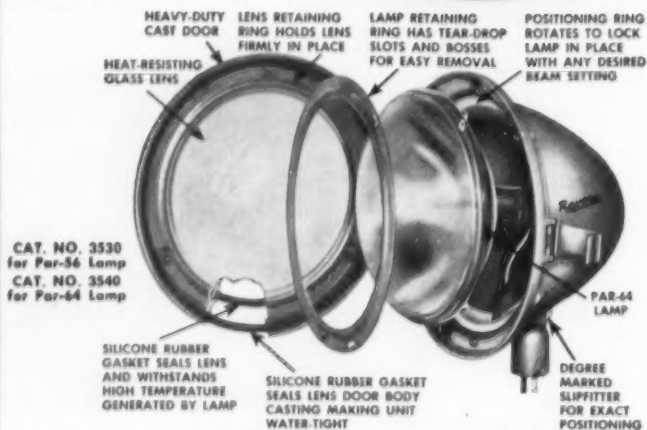
LAMP HOLDER

for use with either a
Par-64 or Par-56 Lamp



Fitter has
90°
markings
above and
below
horizontal.
Covers full
180°.

... a great Revere Lamp Holder that offers great possibilities! Designed so that the lamp positioning rings and the retaining rings are interchangeable—thus accommodating a Par-56, 390 Watt, or a Par-64, 500 Watt Lamp of Narrow Spot, Medium Flood or Wide Flood Type. Not necessary to change the wiring.



- 1 A versatile unit readily adaptable to change in Beam Candlepower.
- 2 Two SILICONE Rubber Gaskets double seal the unit against weather. Gaskets will not char and smoke-up lens.
- 3 STAINLESS STEEL Spring Toggle Latch holds sturdy lens cover — easy working — no fumbling with thumb screws.
- 4 Positioning Ring has slots to hold lamp in any position within circle.
- 5 Ring rotates and locks into place keeping lamp setting constant.
- 6 Lamp position stays put—unaffected during relamping or cleaning.
- 7 Housing precision-cast Aluminum Alloy. Strong, light in weight, dissipates heat faster.

This is a new addition to the extensive REVERE Line of Cluster-Lites and Fittings. With it you produce a workmanlike job that resists corrosion and retains its good looks for years. Write for data.

REVERE ELECTRIC MFG. CO. • 6009-17 BROADWAY • CHICAGO 40, ILL.
Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

THE ONLY COMPLETE LINE OF LUMINAIRES - FLOODLIGHTS AND POLES FOR STREET - SPORTS AIRPORT - SERVICE STATION - OUTDOOR THEATRE - MARINE AND INDUSTRIAL LIGHTING



Lighting Fixture (12)

The latest development in the Sky-liner group of horizontal fluorescent "T" lights is an open type, rounded end unit designed for straight or davit pole mounting. Known as Series "T-1000", it is available with six or eight rapid start or slimline lamps. Two additional auxiliary 36-in. slimline units measure 11 ft 6 in. long overall and are 42 in. wide. All aluminum canopy and box girder chassis are heliarc welded. Provision is made for mounting auxiliary spot or floodlamps to the top of the aluminum box girder cover. Bulletin No. 1082 is available.

Steber Manufacturing Co., Broadview, Ill.

Series Ballasts (13)

A new line of integrally-mounted series ballasts for fluorescent street lighting luminaries. The new series ballasts feature improved constant current transformer loading factors. Efficiency has been increased by 5%, power factor boosted by 13% and OCV reduced by 26%. Other features of the line include two separate 2-lamp ballasts on 4-lamp units; and internal series ballasts molded in rubber for improved insulation and reduced size and weight.

General Electric's Outdoor Lighting Department, Hendersonville, N. C.



Control Center (14)

A new line of control centers, Bulletin 6200 Type W, are available in Type A, B, and C construction with NEMA 1 or NEMA 1-gasketed construction. Space occupied by new control centers is reduced because they are narrower than previous designs. Space required around an installation is also reduced because no access from

why  uses

OKONITE

cables

For their St. Louis plant, Moloney Electric chose Okolite-Okoprene cables—not only for supplying power in their production department, but also for testing their large power transformers. In manufacturing operations of this important nature, the electrical circuits must have two major characteristics—reliability and long life. Here is detailed proof that Okolite-Okoprene cables fulfill these requirements:

1. Okolite insulation's established service record of more than thirty years standing has demonstrated its continued high dielectric strength at a-c voltages up to 35kv and d-c voltages up to 150kv.
2. Okoprene, developed in 1932 by Okonite engineers, has proved its durability as a mechanically rugged and weatherproof protective sheath through use on portable cables in open pit mining operations.
3. Both Okolite and Okoprene are applied by the strip-insulating process which assures metal mold-cured cables, with full, uniform walls of insulation.
4. Okolite-Okoprene cables have wide use in both control and power circuits for all voltages up to 35kv in conduit, underground duct, direct burial, aerial and submarine installations.

Okolite-Okoprene 15kv and 5kv cable installed in the Moloney Electric Company's new testing laboratory. The fabricating plant is also wired with Okolite-Okoprene. Gamp Electric Company, St. Louis, Missouri, made the electrical installation.

If you do not have in your files complete engineering information on high and low voltage rubber-insulated cables, including dimensions, current carrying capacities, and splicing and terminating information, just write for manuals EC-1075 (5kv to 35,000 volts), and EC-1085 (up to 5,000 volts), to The Okonite Company, Passaic, New Jersey.



Available with either copper or aluminum conductors

OKONITE



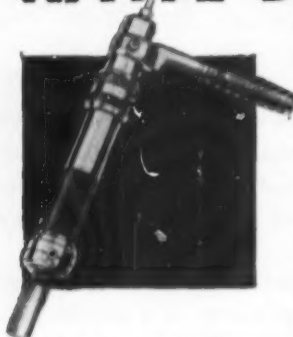
insulated cables

your distributor now has
these **3 NEW RAWL PRODUCTS**
FOR FASTER, BETTER
ANCHORING IN MASONRY...

Be sure of your anchoring work. Use the best anchors. To begin a good job right specify Rawl.

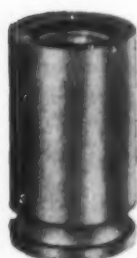
Here are some new additions to the Rawl Product line... If you're not familiar with all our products why not let us send you a catalog?

RAWL DRILL-HAMMER



CONVERTS AN ELECTRIC DRILL, ECONOMICALLY, INTO A DEPENDABLE, FAST, POWER HAMMER. MORE THAN DOUBLES THE VALUE OF YOUR 1/4" ELECTRIC DRILL. Drill quickly into softest or hardest masonry or stone with inexpensive Rawldrills. Saves money — eliminates necessity for using expensive carbide-tipped drills. Automatic clutch starts or stops action automatically when the drill point touches

or is taken away from work. "Light", "medium" or "heavy" blows are selected by turning the collar. RAWLDRILLS TO FIT.



RAWL CALK-IN

Improved machine screw anchor. Sleeve is precision-cast of an exclusive Rawl lead alloy, especially developed for masonry anchors. It's just soft enough for easy, complete caulking and hard enough for tremendous holding power. Sizes up to 5/8".



RAWL SCRUL-LEAD

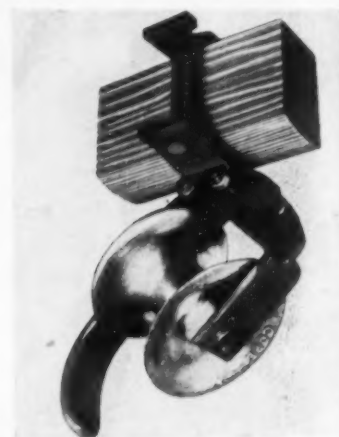
The most holding power possible with any lead screw anchor. Exclusive Rawl lead alloy used for easy installation and huge holding power. The top flare out speeds up anchoring time because screws can be inserted quickly. Use for either wood screws or sheet metal screws.

Write for free new dimensional wall chart and catalog.



rear or sides is required for inspection, maintenance, or removal and replacement of any components including horizontal and vertical bus. Basic vertical unit of line is 20 inches wide, takes six NEMA Size 2 starters.

Clark Controller Company, 1146 E. 152d St., Cleveland 10, Ohio.

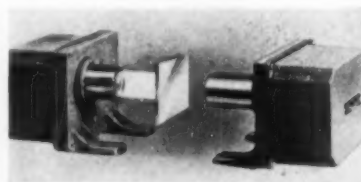


Angle Sheave

(15)

A new angle cross arm sheave, especially designed for pulling cable around corners. The sheave is mounted in an easily-attached steel yoke and will facilitate installation of aerial cable. Angle sheave is adjustable to any angle up to 90°, permitting alignment to any angle of pull. It is available in two sizes: one to accommodate cables up to 3 in. in diameter, the second for cables up to 4 in. in diameter. Sheaves are available in aluminum or malleable iron and are fitted with oilite bushings to reduce friction.

T. J. Cope, Inc., Collegeville, Pa.



Control

(16)

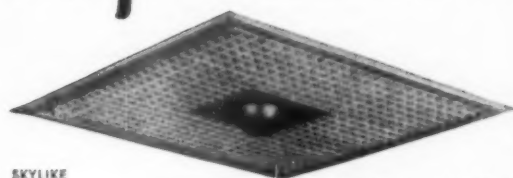
A photoelectric control for operation by glass, cellulose and various transparent materials. Light source produces a light beam of short wave length which glass, cellophane, etc. interrupts. It is actuated by the special light beam at distances up to 5 ft. Minimum phototube light time and phototube dark time is .05 seconds each. Control relay energizes when light is on the phototube. Contacts are DPDT, rated 8 amps at 115-volt ac, non-inductive. Both light source and control have splashproof cast aluminum cases tapped for 1/2-in. conduit. Literature is available.

Autotron, Inc., Box 722-DD, Danville, Ill.

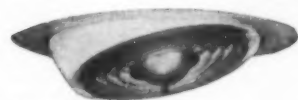


Piggly Wiggly, Inc. Supermarket, St. Louis, Mo. Owner and Operator: Wm. H. Brown

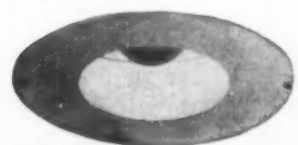
Skylike makes the most out of lighting in... SUPERMARKETS



SKYLIKE



ADJUSTO SILVER-SPOT



SILVER-DOT

Supermarkets have come a long way since the "box and crate days." Modern trends demand an unhurried atmosphere of cheerfulness, friendliness and pleasing color—to make shopping pleasurable—to increase buying moods. Skylike units supplemented by Silver-Dots are being used extensively by foremost designers to achieve this desirable result. Installations, as shown here, prove the effectiveness of their soft, glareless overall lighting combined with accent lighting in displaying foods at their tempting best and by inducing a leisurely selection of non-food, higher profit, traffic items.

If you are modernizing or planning new units it will pay to investigate the Silvray-Skylike line for supermarket lighting.

SKYLIKE LIGHTING, INC.
A SILVRAY ASSOCIATED COMPANY
RKO Bldg., New York • Bound Brook, New Jersey

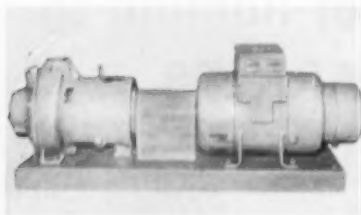




Connector (17)

A lug-type connector for economical terminating at service switches, terminal blocks, or other locations where space and cost are factors. Called "Ka-Lugs," they are available for copper conductors from No. 14 through 500 MCM. Smaller lugs are forged and larger sizes are cast of copper, with a plated steel socket screw.

Burdyn Corporation, Norwalk, Conn.



Turbo-Alternator (18)

60-cycle alternating current can now be produced for regular or stand-by requirements by a new "turbo-alternator" that combines mechanical drive turbine, generator, exciter and voltage regulator in a single unit. For hospitals and other places where utility failure might prove disastrous, or for installations where utility service is not available, this unit provides a constant voltage that keeps lights bright and motors at peak operation. Available in 3.75 to 25 kva capacities, single or 3-phase, and 120/208, 240 or 480 voltages. Unit can be furnished drip-proof, splash-proof and explosion-resistant.

Pyle-National Company, 1336 North Kostner, Chicago 51, Ill.



Fluorescent Lighting (19)

A full line of fluorescent street lighting luminaires, called "First Fluorescent Family." Form 406, 4-lamp, 6-ft unit has now been completely redesigned. Designated Form 406S, it produces 21,200 lumens and is designed

for main streets, bridges and other heavily-traveled areas. It features a new slipfitter mounting which, combined with the leveling cradle support and three cup-pointed set screws, provides ease of installation and secure mounting. Weather-tight, one-piece globe of clear acrylic plastic is side-hinged for relamping and maintenance; wiring has been simplified by use of a terminal board; spring-loaded sockets now provide a simple and secure means of installed new recessed, double-contact base lamps; new resilient gasket material has been combined with latch hinges to form a secure seal with aluminum hood. Other members of "FFF" include Form 202S, a 2-lamp, 2-ft unit that generates 2,700 lumens and designed to produce 6,600 lumens for illuminating secondary traffic areas; Form 206S, a 2-lamp, 6-ft unit that produces 10,600 lumens and designed for application on primary traffic streets; and giant Form 1206S, a 12-lamp, 6-ft unit that generates 64,000 lumens and designed for use on "prestige" streets and whiteways.

General Electric Co., Schenectady 5, N. Y.



Connector (20)

A new, spring type, electrical wire connector that makes solderless, ready-insulated splices in one step. Called "Scotchlok" brand Type R connector, it provides a vibration-resisting pigtail splice that holds regardless of thermal or mechanical changes. Approved by Underwriters' Laboratories as meeting all requirements for high and low voltage building (1000 volts maximum) and fixture (600 volts maximum) wiring. Connector consists of a cone-shaped coil spring within a steel shell to prevent crushing in crowded junction boxes. Vinyl insulating jacket—molded over unit—features a triangular cross-section for better finger grip. It also includes a skirt at bottom to protect wires and prevent flashover. Connector is suitable for use on wire sizes from Nos. 10 to 16 AWG.

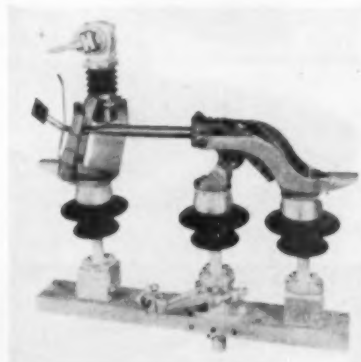
Minnesota Mining and Manufacturing Co., 900 Fauquier St., St. Paul 6, Minn.



Hand Lamp (21)

An explosion-proof portable hand lamp for lighting in flammable atmospheres, such as in the interiors of fuel tanks during cleaning or painting operations. The fixture, Type EVH70, uses 150-watt PAR-38 reflector type spot and flood lamps, which produce a concentrated light pattern. It is UL-approved for Class I, Group C locations or Group D locations. Fixture's cone-shaped aluminum body is ridged with heat-dissipating fins. Its plastic coated fiber handle, located at balance point for carrying, remains cool after lamp has been in use for long periods. Terminal housing, equipped with a cord clamp with tapered watertight rubber bushing, encloses three pressure connector terminals. For areas where moisture is a prevalent working condition, a special version of the EVH fixture is available equipped with O-ring gaskets at the relamping joint and terminal housing.

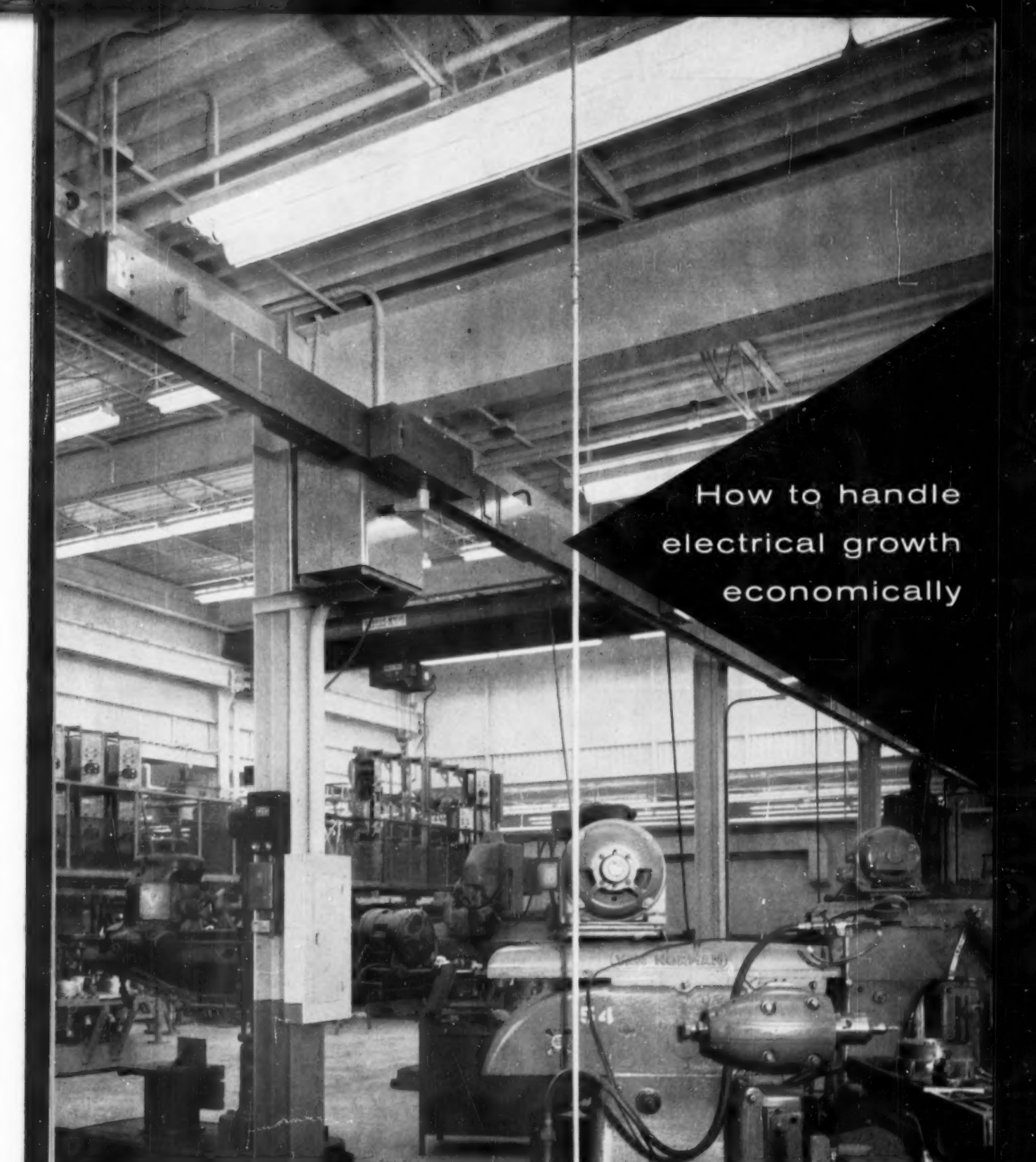
Crouse-Hinds Company, Wolf & 7th North Sts., Syracuse, N. Y.



Switch (22)

A new line of interrupter switches, designated as the MKR-40 Power-upper, are designed to permit safe interruption of load, magnetizing, and charging currents up to 600 amps, without danger of external arcing or flame. Double acting mechanism assures instant arc extinction, either in opening or closing circuit. Switch is available in voltage ratings from 7.2 to 34.5 kv, in continuous current ratings of 400, 600, 1200 and 2000 amps.

Delta-Star Electric Div., H. K. Porter Company, Inc., 300 Park Ave., New York 22, N. Y.



How to handle
electrical growth
economically

WATCH WESTINGHOUSE! →
WHERE **BIG** THINGS ARE HAPPENING FOR YOU!

Here's a Power Source Born With Expansion Plans

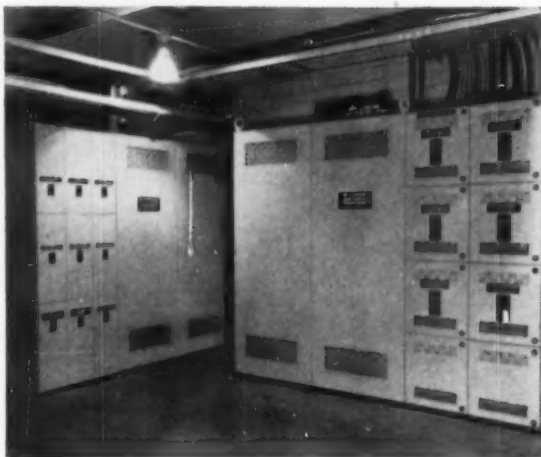
The very fact Westinghouse power centers are conceived with your expansion plans in mind helps you handle electrical growth economically. The secret is "Unitized" design.

New breaker compartment units literally "snap" into place, no matter whether one or a dozen are added. If you have a Westinghouse power center with spare enclosures you need only add the breaker. It's that simple.

But even if you never add one more piece of equipment your investment will begin to pay dividends immediately. These power centers cost less to install because they are assembled in the Westinghouse factory; using high-voltage power close to the load, you eliminate costly runs of secondary lines and you save on actual power because no long wire runs eat up voltage.

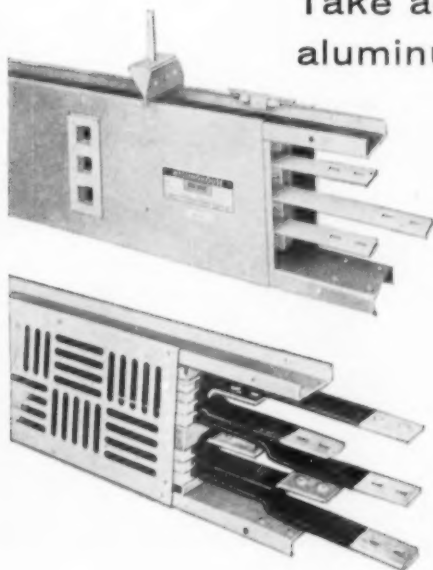
If you use a dry-type transformer, no special, expensive vault is needed. Mount power centers anywhere, out of the way. Think of the extra floor space made available. Ask your Westinghouse representative for power center details today.

DP 5026-B





Take advantage of aluminum bus duct's 15-25% cost savings



DP 5026-C

Aluminum bus duct by Westinghouse is your best distribution material and its delivered cost is now 15-25% lower than copper duct. Besides this savings Westinghouse guarantees the same top quality and performance and longevity with aluminum built into copper-bar bus systems.

If you already have a bus duct system, new runs of aluminum duct can be added to meet growing electrical distribution demands. At substantial installation timesavings as well. Up to 35% less weight in aluminum makes it handle easier, go up faster.

If you have never used bus duct, seriously consider these benefits: prefabricated sections that make hanging hours faster; prefabricated fittings to run duct in any direction or around obstructions; salvageability up to 100% when system changes occur; neat appearance; and as much as two-thirds less space required than for cable and conduit.

Write today for additional information. Ask for booklet B-6740. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. And remember, you can be sure if it's Westinghouse.

WATCH WESTINGHOUSE!

WHERE BIG THINGS ARE HAPPENING FOR YOU!



Save up to 40% labor costs with Westinghouse control centers

A Westinghouse control center installation requires about 40% less labor costs than a decentralized method of control. A saving in time and material you can't afford to be without.

This is possible because an entire control system is contained in one unified structure. Gone are the costly drawbacks of scattered controls. And when economic growth demands more control apparatus you can count on the same savings.

Under this setup, servicing is easier, too. One or a few authorized men can supervise all operations.

Dead-front construction, and the fact that they are housed in a single unit apart from working areas, creates a condition of safety which actually improves the working atmosphere and personnel morale.

Your Westinghouse representative can give you more reasons why you should include a modern control center by Westinghouse in your next project. Remember, you can be sure if it's Westinghouse.



Switch to mercury to double light output without rewiring



Many plants have found their incandescent lighting systems loaded to capacity. One solution is to rewire the entire system at no little expense. The best answer is to switch to mercury lighting. Westinghouse High-Bay mercury lighting.

By this method you can double light output for the same wattage and completely eliminate the need for rewiring.

But Westinghouse has built in other plus features in High-Bay lighting that make it even more advantageous to use. For example, these rugged units are virtually maintenance free. Air circulation through an opening between the neck and reflector sweeps the reflector surface clean. Remember this, next time you contemplate an installation over 20 feet from the floor.

For a lot of other pertinent facts about Westinghouse mercury High-Bay lighting ask the Westinghouse man in your locale. You can be sure if it's Westinghouse.

WATCH WESTINGHOUSE!

WHERE BIG THINGS ARE HAPPENING FOR YOU!

DP 5026-E





Ask these questions, too, when you judge a fluorescent lamp...



Is your investment protected?

Check Westinghouse Fluorescent Lamps against any other brands you are now using. Check them for maintained brightness, long life, uniform appearance. If you are not entirely satisfied on all counts, your full purchase price will be refunded.



How about quality control?

From raw materials to finished product, every Westinghouse fluorescent lamp is subjected to 480 inspections and tests before approval for shipment.



Is it the correct type, size and color for the lighting job to be done?

In the Westinghouse fluorescent family of 290 different lamps—including Slimline and Rapid Start—there's a type and size precisely right for every office, plant and merchandising application. Colors include seven different shades of "white" alone.



For the full story on how to get more for your money in fluorescent light, contact your Westinghouse Lamp Representative.

WATCH WESTINGHOUSE

WHERE BIG THINGS ARE HAPPENING FOR YOU!



Transformer (23)

A new design of the 25 kva Gardner distribution transformer has resulted in a reduction of approximately 10% in weight and height, and more than 10% increase in core efficiency. Significant design change is the placing of eight radiator tubes, four on each side, on the outside of the tank. This 25 kva, 12,000-volt OISC distribution transformer, is designated Type "S".

Gardner Transformer Division of Federal Pacific Electric Co., Emeryville, Calif.



Lug (24)

The new PennLug has a circular boss to which the insulation butts flush in full circle, giving a snug fit and easier taping. There is up to 11% more contact area with conductor than cylindrical or hexagonal bodies, and serrations give higher resistance to horizontal pull. Lug is made in seven sizes, from 500-100 MCM to 14 solid-8 stranded.

Penn-Union Electric Corp., Erie, Pa.

Intercom System (25)

Interdiocom, a new home intercom and radio, is a sensitive system which can service five relay stations within the home, permitting simultaneous radio and inter-room communication reception at each or any of the outlets. Master control panel includes a radio, intercom, clock, electric timer, ac socket 5-position switch, safety interlock, jewel pilot light indicator and phono jack. Set includes four relay stations, each with

5-in. permanent-magnet heavy duty speaker, and an entry door relay station with a pushbutton bell. It allows complete communication between various parts of the house, protection from intruders at door and music in all rooms in the house. Unit allows use of radio and interphone at same time.

Stratford Corp., 745 Fifth Ave., New York, N. Y.



Fluorescent Fixture (26)

Salisbury and Roxbury fixture series give fluorescent lighting a new slim dimension. They are 2 1/2-in. high with a choice of glass and plastic. Removable bottom enclosure for properly diffused light for a wide range of seeing requirements in schools, stores, offices and similar locations. Available in 12- and 24-in. widths for two, three, four, six and eight 48-in. rapid start lamps. Ballasts in the Salisbury are mounted in ends, side panels are luminous. In the Roxbury, ballasts are side mounted, side panels are all metal.

Fullerton Manufacturing Corp., Willard Road, Norwalk, Conn.



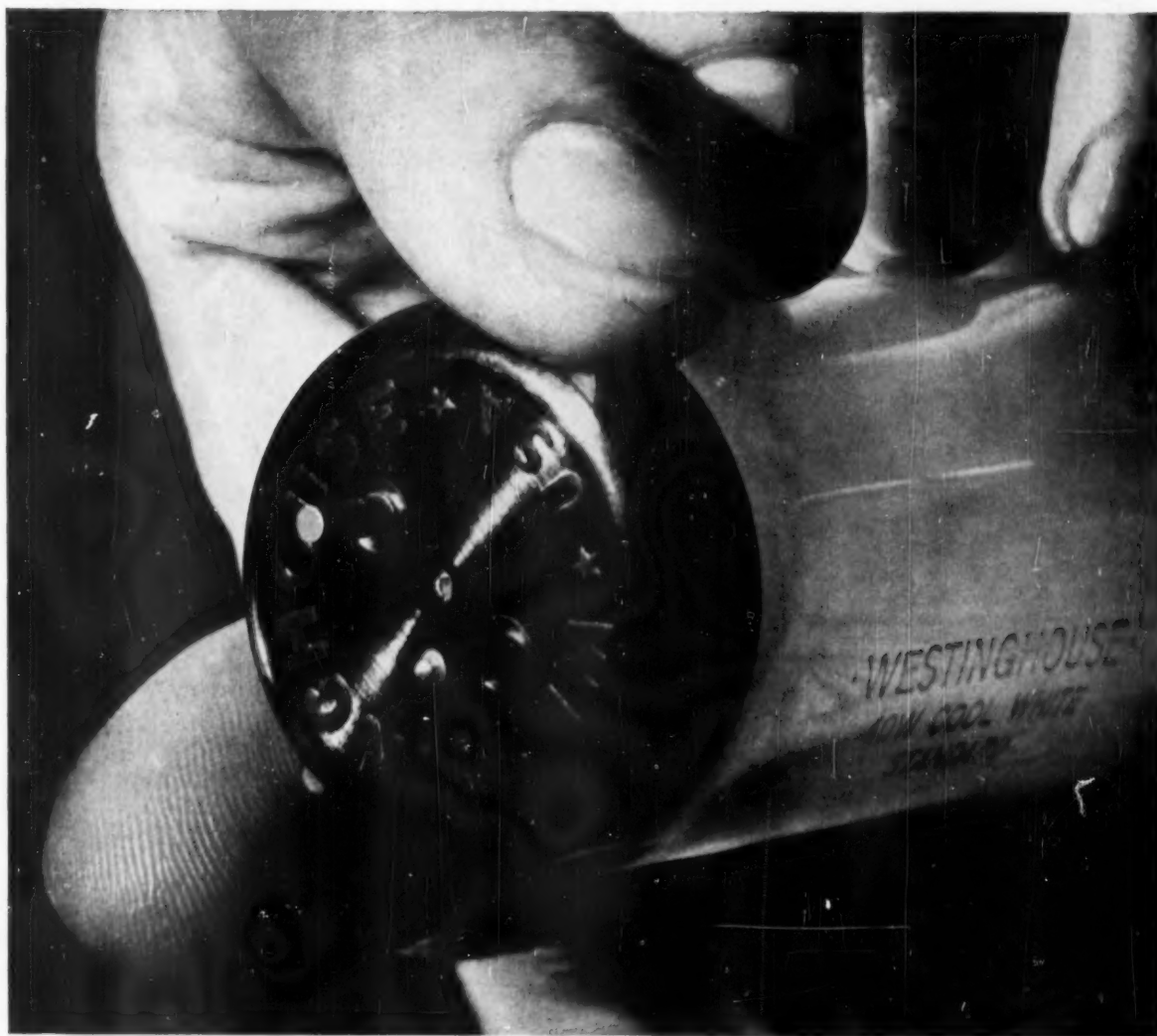
Heaters (27)

A new electrical unit heater for offices, stores and industry. It uses a non-glowing, black heat type element with a specially developed fan blade that provides an even flow of heated air. The replaceable element itself is steel covered and protected against overheating by a built-in thermal cut-out. Unit is designed for continuous or automatic control to maintain temperatures as required. For normal service sizes range from 1 1/2 to 7 1/2 kw. Extra heat capacity units range from 9 kw to 15 kw. Bulletin 806 is available.

Ilg Electric Ventilating Co., 2850 N. Pulaski Road, Chicago 41, Ill.

how to judge a fluorescent lamp

... point no. **10**



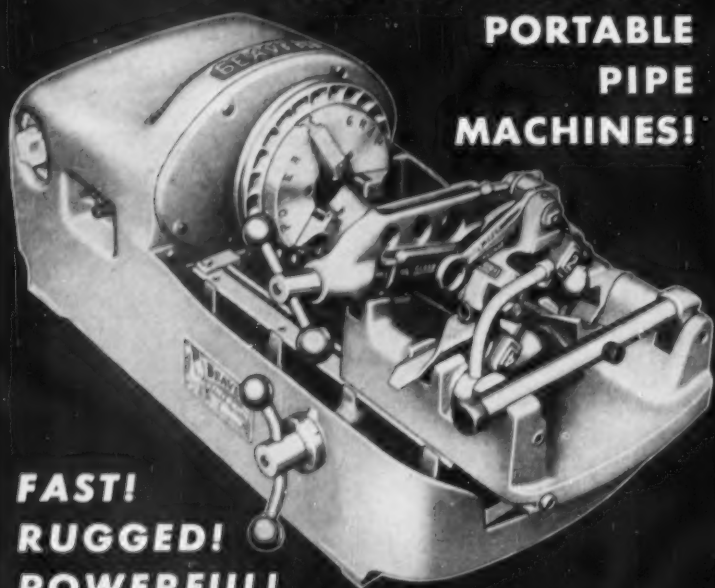
ask about **SECURE
SEATING**

Secure seating of a fluorescent lamp means secure positioning of the lamp in its fixture. It's especially important in factory applications, where normal vibration can cause improperly seated lamps to drop out. Westinghouse solves the seating problem two ways. *First*, by means of "guide bumps" on the end-caps (above). *Second*, with uniform, accurate lamp length. The guide bumps are easily felt with the fingers, easily seen; a touch or a glance during lamp installation tells when the lamp is secure in its sockets. Accurate length assures that every lamp will exactly fit its fixture. Result: secure seating for every lamp, with "drop outs" virtually eliminated.

WATCH WESTINGHOUSE
WHERE **BIG** THINGS ARE HAPPENING FOR YOU!

THE LAST WORD IN PORTABLE PIPE MACHINES!

**FAST!
RUGGED!
POWERFUL!
LIGHT—ONLY 170 LBS!**



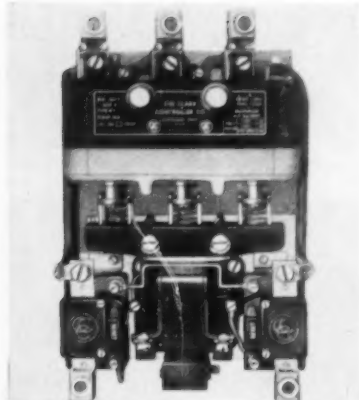
The ALL NEW BEAVER Speed-O-Matic

PORTABLE PIPE AND BOLT MACHINE

- 50% more speed and power from faster, all new motor! Motor and switch fully protected.
- New "CLEAR-VU," self-centering wheel and roller cut-off; die heads with high-speed steel dies; and reamer, all pivot mounted! Ideal for "make-up."
- Quick-acting Power Grip Wrenchless Chuck—forward or reverse!
- Threads $\frac{1}{8}$ " to 2" pipe (up to 12" with drive shaft) $\frac{1}{4}$ " to 2" bolts.
- Instant and accurate easy-setting spool-type pipe support eliminates double chucking.
- Lubricated for life!
- Oiling tube directs oil right to threading dies! Shuts off automatically.
- Lathe-type thread length indicator.



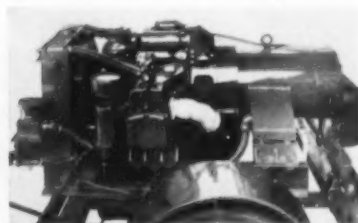
Can't tell it all here!
Send for New Beaver
Quick Reference
Catalog! Get the
latest facts on
ALL new Beaver
machines!



Magnetic Starter (28)

A Size 4 ac magnetic starter has been added to the line of Type "CY" starters. All maintenance and inspection, including removal and replacement of components, is from the front. They utilize the Clark combination of twin-break contacts and multi-turn magnetic blowouts. Magnetic coils around each stationary contact either lengthen or compress the arc, depending on direction of current flow at time of interruption, and cause arc to rotate. The constantly moving arc distributes the effects of arcing over the entire surface of both contacts, minimizing pitting, burning and erosion.

Clark Controller Company, 1146 E. 152d St., Cleveland 10, Ohio.



Generator (29)

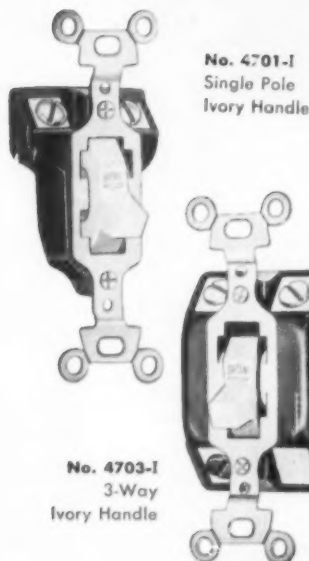
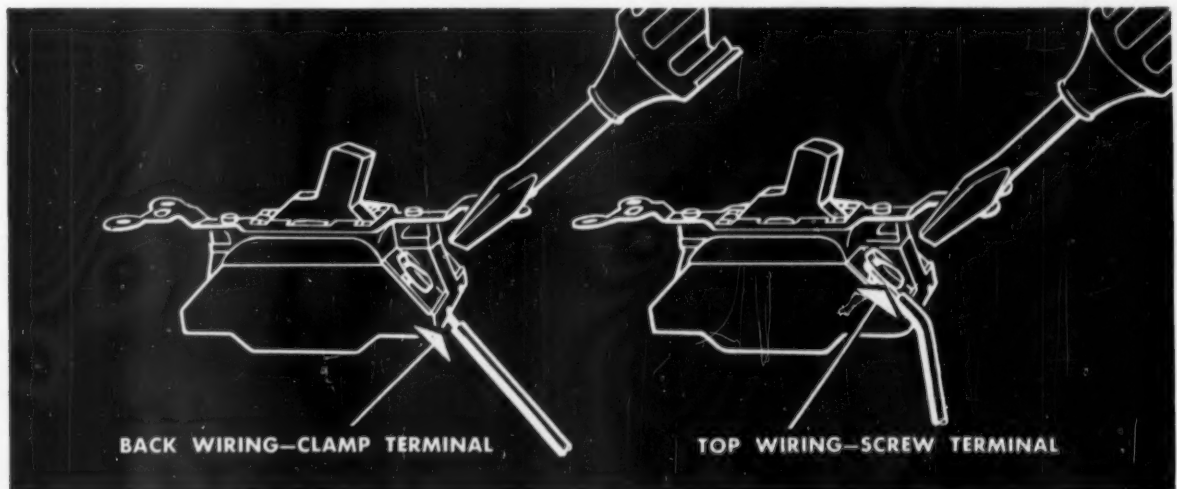
The portable, Witte Model 100-RDA engine-generator unit is designed to produce 12,000 watts continuously, 24 hours a day. It is direct connected to an 18 hp, water-cooled diesel engine. Engine is designed with two horizontally-opposed cylinders. Farmers, ranchers, construction camps, road and building contractors, etc., will find these units useful as a full time power source or as a standby in case of an emergency or commercial power failure. Approximate overall dimensions are: length 65 in.; height 30 in.; and width 39 in. Design and maintenance features of engine include: wet-type replaceable cylinder liners, precision aluminum bearings, replaceable valve guides and valve inserts, dynamically balanced crankshaft, and full-pressure lubrication.

Witte Engine Works Oil Well Supply Div., United States Steel Corp., 1614 Oakland Ave., Kansas City, Mo.

NEW DESIGN

BRYANT SILENT MERCURY SWITCHES

Higher Rating • Optional Wiring • Easier to Install



Control Tungsten Filament or Fluorescent Lamp Loads at Full Rated Capacity

HIGHER RATING—15 Ampere 120 Volt A.C. Rating makes this switch particularly desirable for the control of tungsten filament and fluorescent lamp loads without derating. A.C.-D.C. Rating — 10 A. T. 125 V. — 5 A. 250 V.

OPTIONAL WIRING—Either screw terminal top wiring or clamp terminal back wiring.

EASIER TO INSTALL—Unique design permits rapid connections — whether top or back wired.

APPLICATIONS—Especially suited for hospital, residential and other installations where completely silent operation is desired.

AVAILABLE—In single or double pole, 3 and 4 way types with brown or ivory handles.

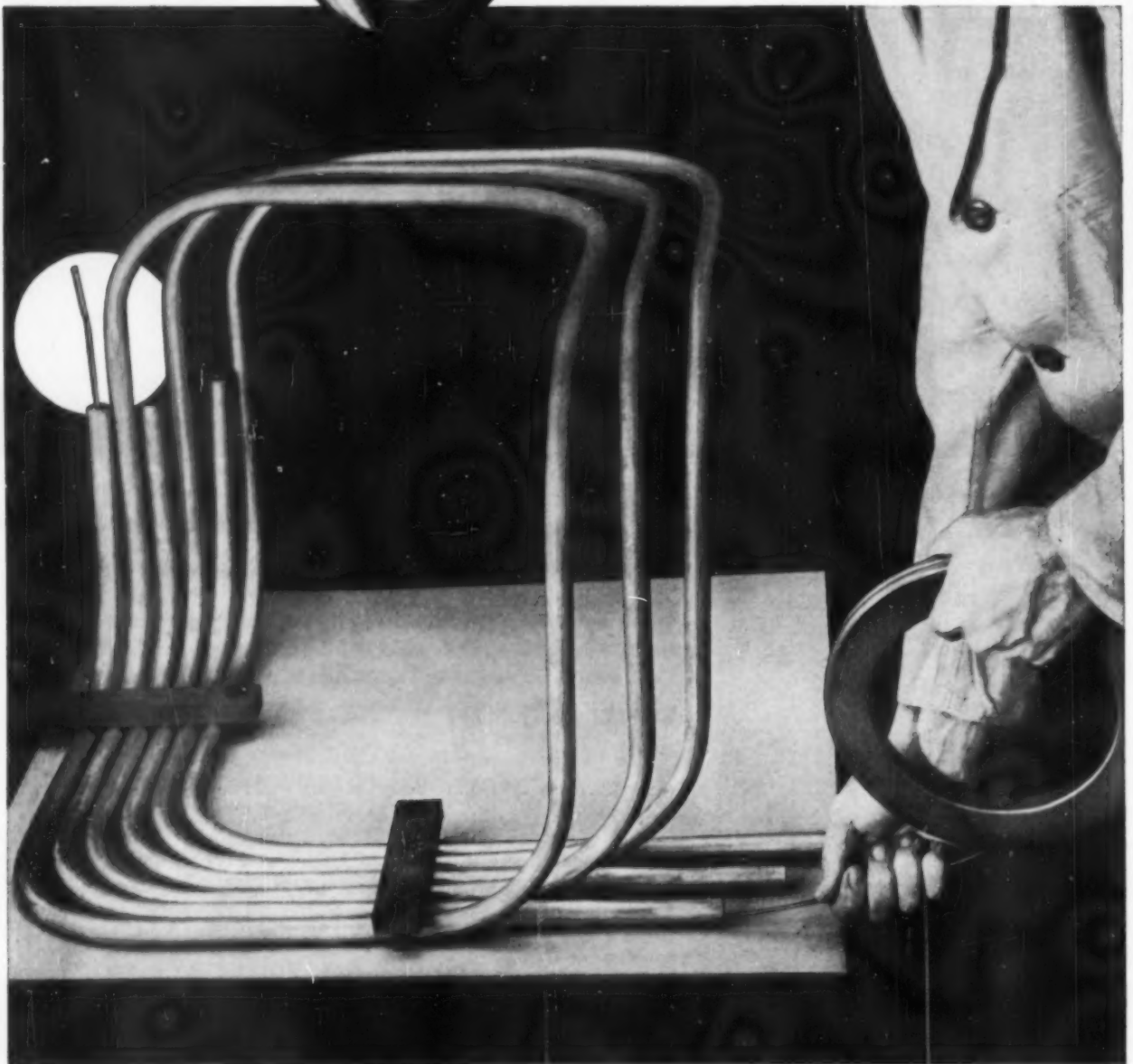
Listed by
Underwriters'
Laboratories, Inc.
J-99970



THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut • CHICAGO • LOS ANGELES

New Rome EMT



Fish-Tape Slips Right Through Rome EMT. No amount of forcing would get a $\frac{1}{8}$ -inch fish tape through two competitive lengths (behind Rome EMT). Here the same tape is shown as it slides right past all eight 90-degree bends in the Rome EMT.

proved best in fish-tape test

Actual comparison test proves Rome EMT easiest to fish

In recent tests, Rome Cable's EMT came out first in fishability. Disinterested observers checked the results with X-ray photos.

How the test was conducted:

Disregarding the National Electrical Code's limit of four bends, technicians bent a whole series of ten-foot lengths of 1/2-inch EMT into identical eight-turn runs for testing purposes.

A standard 1/8-inch fish tape was then run into the test samples. It went easily through all eight bends in Rome EMT. In every competitive sample, the tape stuck fast at one of the bends!

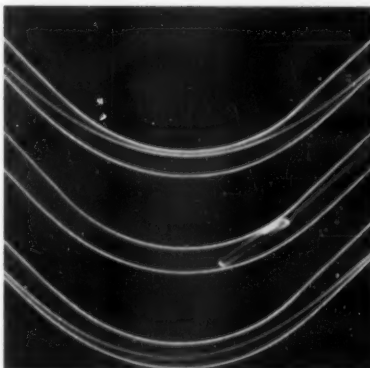
Why Rome EMT is easiest to fish

A shiny new interior lets fish tapes slide through with an absolute minimum of resistance. Careful baking—under rigid control—puts a uniformly smooth enamel finish inside Rome EMT.

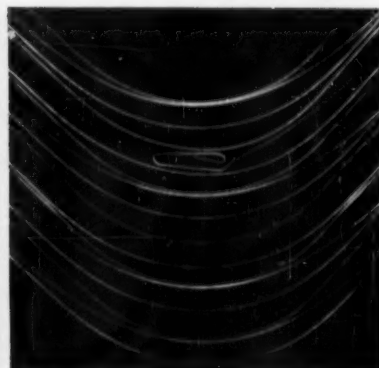
Test it yourself

Pick any competitive EMT, bend it identically with a length of Rome EMT, and then try the fish-tape test. You'll find that Rome Cable wins every time in this test of direct comparison.

Specify Rome EMT for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 902, Rome Cable Corporation, Rome, N. Y.



Manufacturer "A" A 1/8-inch fish tape is being forced into this competitor's EMT. The X-ray photo (top) shows how the tape stuck fast on the fourth bend—as a result of a high-friction inside finish.



Manufacturer "B" The same fish tape is being run into another competitor's EMT. The X-ray photo shows the tape—stuck here on the seventh bend. Inside surface resistance caused this tape to stick.



Disinterested Observers from the Anstice Co., Inc., Rochester, N. Y., take X-ray photographs during tests. The photographing was witnessed by Chester Uffelman, Notary Public.

STOCK DISTRIBUTION CENTERS

Atlanta, Ga.
Chicago, Ill.
Dallas, Texas
Denver, Colo.
Houston, Texas
Kansas City, Mo.
Los Angeles, Calif.
Rome, N. Y.
Salt Lake City, Utah
San Francisco, Calif.
Seattle, Wash.
St. Paul, Minn.
Torrance, Calif.

ROME CABLE

C O R P O R A T I O N

Blackhawk's NEW One-piece Box Support

Speeds up work

Simple

A single piece that goes in easily and stays put — frees the electrician's hands for the work.

Quick

The Blackhawk patented one-piece box support is installed all at once — permits more jobs, more profits.

Permanent

The Blackhawk box support provides rigid, unified support because it is a large, single piece — does not wiggle or saw, because it is parallel to the wall.

Superior installation in seconds



Ask Your
Electrical Distributor

Cat. No. 540
Patent No. 2518912

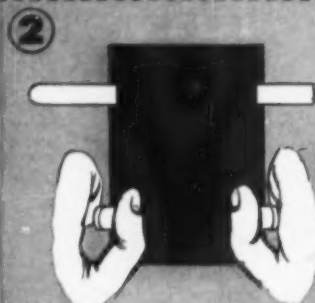
Specify B-1 when you buy!

BLACKHAWK INDUSTRIES

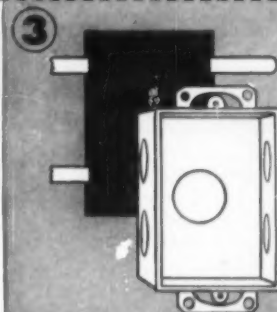
DUBUQUE, IOWA



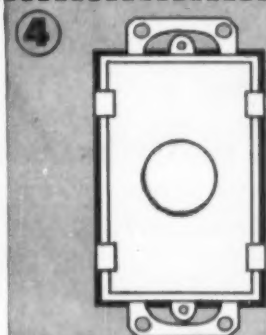
The Blackhawk One-Piece Box Support is inserted all at once — no extra parts to handle or drop.



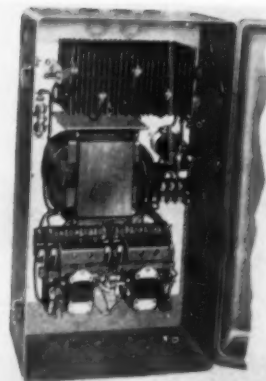
Tabs are simply bent around the wall edge, and the Blackhawk Box Support is ready to receive the switch box.



Both hands are free to install the box. Meanwhile the Blackhawk One-Piece Support takes care of itself.



Tabs are bent to the inside of the box, holding it tight. The broad, single support surface does not wobble or cut.

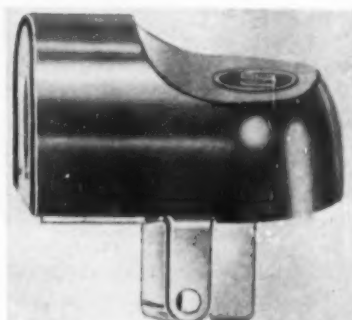


Controller

(30)

New DynAC packaged control and braking systems can be applied to all standard ac motors. Compact and self-contained in NEMA 1 or 12 enclosures, controllers can be installed without any mechanical alterations to motor. To accomplish braking, direct current from a selenium rectifier is applied to one phase of any squirrel-cage or wound rotor motor. A timing circuit allows direct current to flow only long enough to stop motor. They are available with a braking unit only or as a complete braking and starting unit for either nonreversing or reversing service. A circuit breaker, a fusible or non-fusible disconnect, and other modifications can be added to any of the systems.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

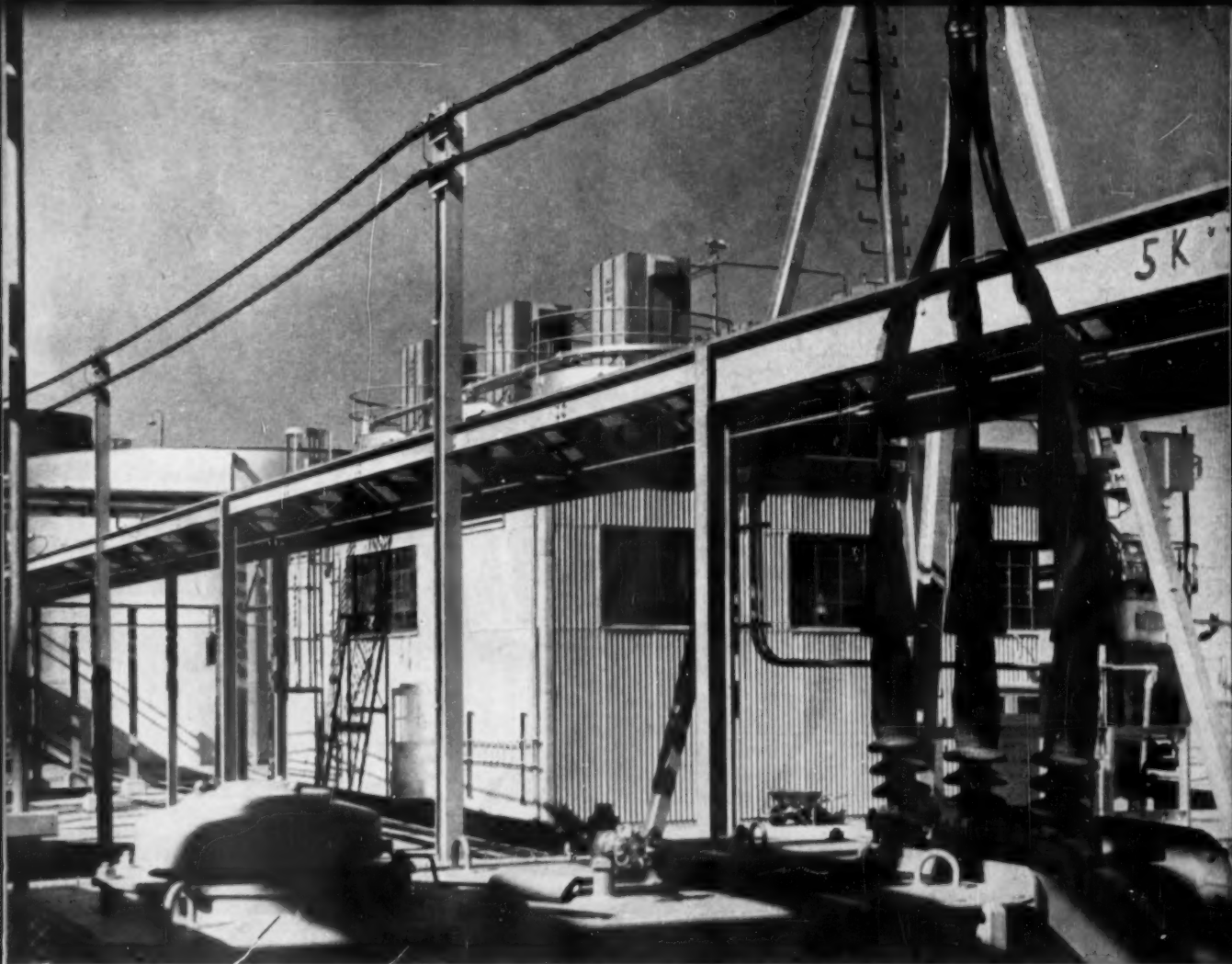


Angle Cap

(31)

A new 3-wire, 50-amp, 250-volt polarized 90° angle cap made of rubber for flush or surface outlets. Designed for heavy duty applications in both industry and the home. For use with industrial portable welding equipment, assembly line portable tools and other electrical equipment. In the home it is suitable for use with such heavy duty appliances as kitchen ranges, freezers, etc. A 1.062-in. cord hole is standard with this 3-wire angle cap, which has 2-screw contacts. Optional ground straps permit grounding of a fourth wire.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.



Heads above the crowd, Anaconda Aerial Cable makes a fast, neat, low-cost installation at oil refinery.

How to handle high voltage with a low overhead

Anaconda Aerial Cable goes over crowded areas... gives highly reliable service at low cost.

Pipes and other underground structures often make installation of ducts or buried cable costly and difficult. The ideal answer: Anaconda Aerial Cable.

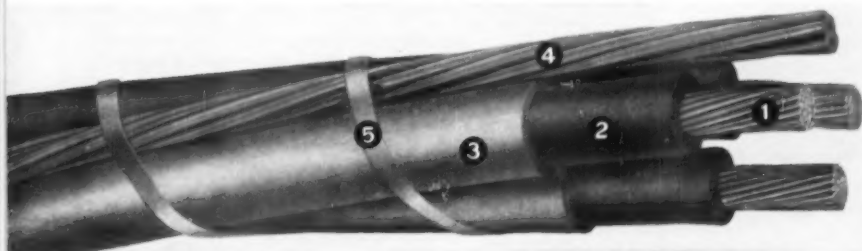
See how easy it is to install—no ducts, crossarms or insulators are needed. Even if underground obstructions are not a factor, this rugged neoprene-jacketed

cable costs much less than buried systems.

Neoprene jacket resists weather and abrasion. Special Anaconda Type AB butyl high-voltage insulation gives extra protection against ozone, heat, moisture and fumes.

For the full story, call the Man from Anaconda or your nearest Anaconda distributor. For information on Aerial Cable write to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

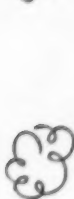
502RT



1. Conductors—copper or aluminum
2. Ozone-, moisture- and heat-resistant butyl insulation
3. Neoprene weather-resistant jacket
4. Messenger
5. Binder Tape

ASK THE MAN FROM **ANACONDA®**
FOR AERIAL CABLE

Stuck Valves
Hard-to-Heat Spots
Frozen Pipes
Sluggish Materials
Underheated Rooms



Do something about it NOW!
This FREE book tells you how



Here's brand new application information on hundreds of uses of Chromalox Electric Heating Equipment for winter weather problems. These factual reports provide you with a rich source of ideas tailored strictly to winter heating problems in and around the plant and office.

Whether it's room heating, de-icing, snow melting, warming of materials, or any of a hundred winter heating jobs, this exclusive information will show you how to solve the problem the electrical way.

Edwin L. Wiegand Company

7637 Thomas Boulevard
Pittsburgh 8, Pa.

MAIL THIS TODAY!



EDWIN L. WIEGAND COMPANY
7637 Thomas Boulevard, Pittsburgh 8, Pa.

Gentlemen: Rush my copy of
How to Solve Winter Problems with Electric Heat to:

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

© 1954

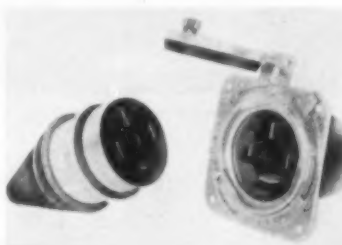


Lamps

(32)

A complete line of "projector color" lamps for outdoor use—red, yellow, green, blue, blue-white, and pink, for lighting motels, gardens, signs, displays, building facades, fairs and carnivals, shopping center areas and walkways, drive-ins, and theater marquees. The line is a 150-watt, PAR 38 bulb, 115-125 range voltage, medium skirted base, with translucent ceramic enamel color fused to outside of bulb. By blending the light from two or more different color lamps, a variety of hues can be produced. Heat resistant glass bulb has a sealed-in reflector and lens. Bulb for lamps is made of heat resistant glass.

General Electric Co., Nela Park,
Cleveland 12, Ohio



Fittings

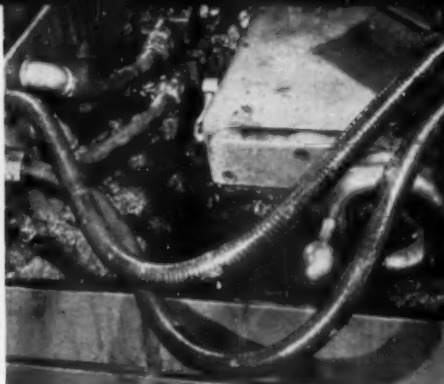
(33)

Grounding type electrical fittings consisting of male and female receptacles and plugs provide a completely matched, polarized assembly rated at 50 amps 250 volts. Designed primarily as a connection from mobile home to electric power in a trailer park, the assembly provides sufficient current to service all of the extra equipment used in mobile homes, such as air conditioning, washing machines and dryers, etc. Four heavy duty terminals are inserted in Bakelite cores, and the cores fit into a steel housing. Wires are connected by means of a griplock on one end of the terminals, and are held firmly. Cores and matching cable are color coded. Receptacle housing is equipped with a cover, and a locking ring locks plug into receptacle when assembled.

Theodore Bargman Co., 16425 Ham-
ilton Ave., Detroit 3, Mich.



Sealtite resists corrosive mixture of powdered calcium sulphate, magnesium oxide and magnesium chloride.



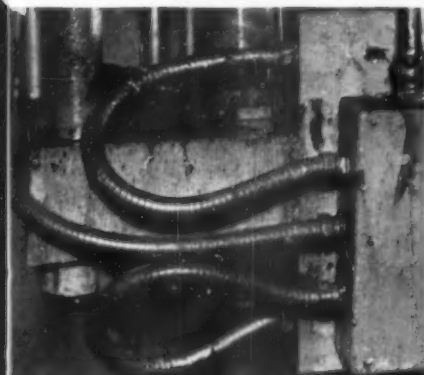
Sealtite protects grinder motor leads . . . flexes continuously under abrasive coat of metal dust, oil and coolant.



In paper mill's steamy air, Sealtite is covered with oil and wet pulp containing chlorine and caustic soda.

Give the dirtiest jobs to

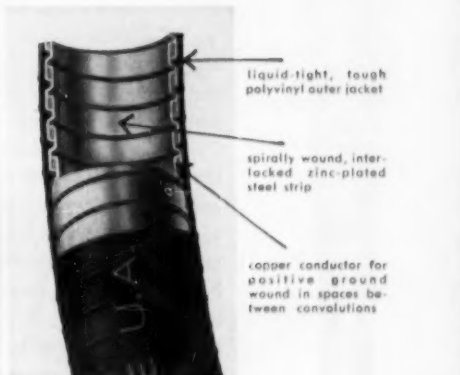
SEALTITE flexible, liquid-tight conduit



Sealtite makes tight bends on hydraulic press, keeps motor leads free from oil, grease and water.



Sealtite keeps weather out of leads to outdoor pump motor.



Cutaway shows construction details of Sealtite Type UA.

Sealtite is made in two types. Specifications in table below. Type UA is approved by Underwriters' Laboratory for service in wet spots. Available in light gray as well as black.

Type EF meets JIC standards. Extra flexible . . . ideal for machine tool applications. Standard stock colors: black, and machine tool light gray at no extra cost.

SEALTITE TYPE E. F.

Trade Size (In.)	INSIDE DIAMETER (Inches)		OUTSIDE DIAMETER (Inches)		Appr. Inside Bend Diam. (In.)	Est. Wgt. (Lbs. Per 100 Feet)	Feet Per Std. Coil
	Min.	Max.	Min.	Max.			
1/8	.485	.505	.690	.710	5	24.0	250
1/4	.620	.640	.820	.840	6	29.0	200
3/8	.815	.835	1.030	1.050	9	38.5	200
1/2	1.030	1.055	1.290	1.315	10	68.0	100
3/4	1.370	1.395	1.630	1.655	13	87.5	100
1 1/8	1.575	1.600	1.875	1.900	15	117.0	50
1 1/2	2.020	2.045	2.350	2.375	17	155.0	50
2	2.480	2.505	2.850	2.875	20	198.0	50
2 1/2	3.070	3.095	3.470	3.500	27	282.0	20
3	4.000	4.050	4.465	4.500	34	414.5	20

SEALTITE TYPE U. A.

Trade Size (In.)	INSIDE DIAMETER (Inches)		OUTSIDE DIAMETER (Inches)		Appr. Inside Bend Diam. (In.)	Est. Wgt. (Lbs. Per 100 Feet)	Feet Per Std. Coil
	Min.	Max.	Min.	Max.			
1/8	.484	.504	.690	.710	8	30.0	200
1/4	.622	.642	.820	.840	10	36.6	200
3/8	.820	.840	1.030	1.050	15	48.2	150
1/2	1.041	1.066	1.290	1.315	18	87.7	100
3/4	1.380	1.410	1.630	1.660	21	116.5	50

Sealtite* flexible, liquid-tight conduit gives wiring maximum protection against oil, grease, water, dirt, chemicals, corrosive atmospheres and weather. Nothing gets through its tough, polyvinyl outer covering. It stands up under continuous flexing . . . absorbs vibration, connects moving parts . . . connects misaligned outlets . . . prevents burn-outs. For long runs or short leads it's easy to install . . . saves the time it would take you to cut, bend and fit rigid conduit.

ELECTRICAL WHOLESALERS stock Sealtite in easy-to-handle coils. Buy it this way in long lengths . . . cut it on the job without waste. Your electrical wholesaler also stocks liquid-tight connectors. For more information write for Sealtite bulletins. Address *The American Brass Company, American Metal Hose Division, Waterbury 20, Conn.*

*Trade Mark

66162 Rev.



Insist on Conduit marked "Sealtite" on cover.

SEALTITE FLEXIBLE, LIQUID-TIGHT CONDUIT

AN **ANACONDA**® PRODUCT

A NEW Super Flexible MICROPHONE CABLE BY

For greater flexibility, longer life, and better service, Whitney Blake has introduced a completely new microphone cable design. This cable has a semi-conducting textile wrap that replaces the conventional copper shield. A stranded flexible drain wire is cabled under the cotton shield in order to eliminate the customary, time-consuming, pigtail used with copper shielded cables. Conductors are cadmium copper for improved flex life and insulated with high quality rubber. The cable is not subject to damage by twisting and by the pressure of heavy equipment running over it. The use of the textile shield removes the objectionable stiffness inherent in copper shielded construction. There is no danger of the shield breaking as a result of continued flexing. Noisy circuits caused by intermittent opens of braided metal shields are non-existent. The neoprene jacket will resist abrasion, oil, grease, perspiration, sunlight, and acid fumes.

WHITNEY BLAKE ALSO MAKES . . .

SPEECH INPUT and SOUND SYSTEM WIRES in Semi-rigid polyvinyl chloride and enamel textile types . . . POLYVINYL CHLORIDE INSULATED SIGNAL WIRES . . . MULTICONDUCTOR PAIRED INSIDE WIRING TELECABLE®

WB HAS that which so many others have yet to gain . . . EXPERIENCE

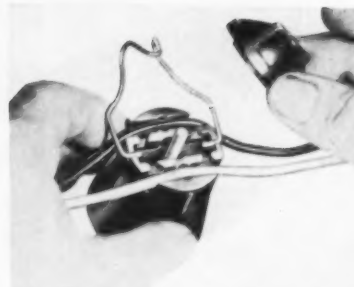
WELL BUILT WIRES SINCE 1899



© 1956

WHITNEY BLAKE COMPANY

NEW HAVEN 14, CONNECTICUT



Socket

(34)

A new weatherproof pin-type socket for temporary illumination is for use with No. 12 or No. 14 RW rubber covered, stranded wire. Socket is connected directly to wire by screwing on cap. Especially useful for temporary, decorative lighting, sockets can be used over and over again on many special jobs. An extra ring, molded into cap, forces wire into position on pins, while four splines molded into each wireway, center the wire automatically. Each socket is furnished with a detachable wire hanger. Approved by Underwriters' Laboratories, Inc., it is rated at 660 watts, 250 volts.

Pass & Seymour, Inc., Syracuse, N. Y.



Power Outlet

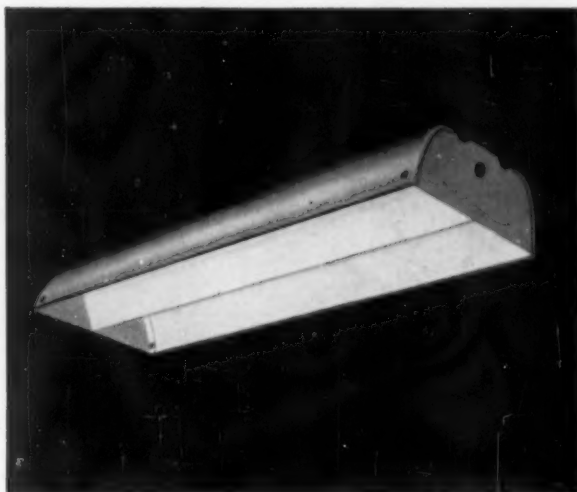
(35)

New Model 5015 weatherproof power outlet is designed to receive power cords fitted with a wide variety of plugs and adapters and is suitable for use in mobile home parks. Power outlet contains a 50-amp, 250-volt, polarized range receptacle, which is equipped with a special grounding plate for 90° angle range caps and is protected by two 30-amp circuit breakers. These may be removed and replaced with other standard receptacles and breakers up to 50-amp capacity. Outlet also has a 15-amp, ground-type, duplex receptacle and a 30-amp fuse plug receptacle. Components assembled on panel have been pre-wired and only connections necessary are the incoming service wires and an equipment ground, for which a lug is provided. A 1-in. hub on top and knockouts on bottom of unit facilitate connections for either underground or overhead wiring.

Hoffman Engineering Corp., Anoka, Minn.

no more tunnels

with Curtis 6000 Industrial Series Luminaires



■ "Tunnel-effect" lighting, common in industrial areas, is a condition of high brightness ratios and annoying glare, causing the eye-strain and fatigue that's responsible for low efficiency and many accidents.

Curtis 6000 Industrial Series luminaires eliminate those "tunnels" by providing a 25% up-light component, with 75% of the light output placed on the work surface.

With Curtis 6000 Industrial Series luminaires, there's a wide selection of equipment to choose from so that every requirement and condition is easily met.

FINISHES

Curtis 6000 Industrial Series luminaires have side reflectors of:

- Alzak processed high purity grade aluminum, a non-tarnishing, non-corroding lifetime surface that's easily maintained.
- white porcelain enamel on enamelling iron, a smooth and durable finish.
- baked white Fluracite enamel on steel, a tough resilient surface that resists peeling or checking.

LAMPS

Curtis 6000 Industrial Series luminaires can accommodate all 4', 5' and 8':

- Slimline Lamps • Rapid Start Lamps • High-Output Rapid Start Lamps • Starter Type Lamps

INSTALLATION

Curtis 6000 Industrial Series luminaires can be installed in many ways, all of them fast, easy and economical.

- Curtis patented "Tong" Hangers clamp anywhere on the channel, by-passing all building obstacles, and it's designed to clamp at the juncture of two units, the only "Tong" hanger of its kind.
- Curtis Wire Entrance Hangers have fast slip-over type hiccups that save time and money.
- And Curtis 6000 Industrial Series luminaires can be chain suspended or installed on messenger cables.

These are only a few of the reasons for using and specifying Curtis 6000 Industrial Series Luminaires. Send the coupon for specifications and remember, with Curtis 6000 Industrial Series luminaires, there are no more "tunnels" of light.

CURTIS LIGHTING, INCORPORATED

6135 W. 65th St., Chicago 38, Illinois



in California
242 S. Anderson St.
Los Angeles 33, California

in Canada
195 Wicksteed
Toronto 17, Canada

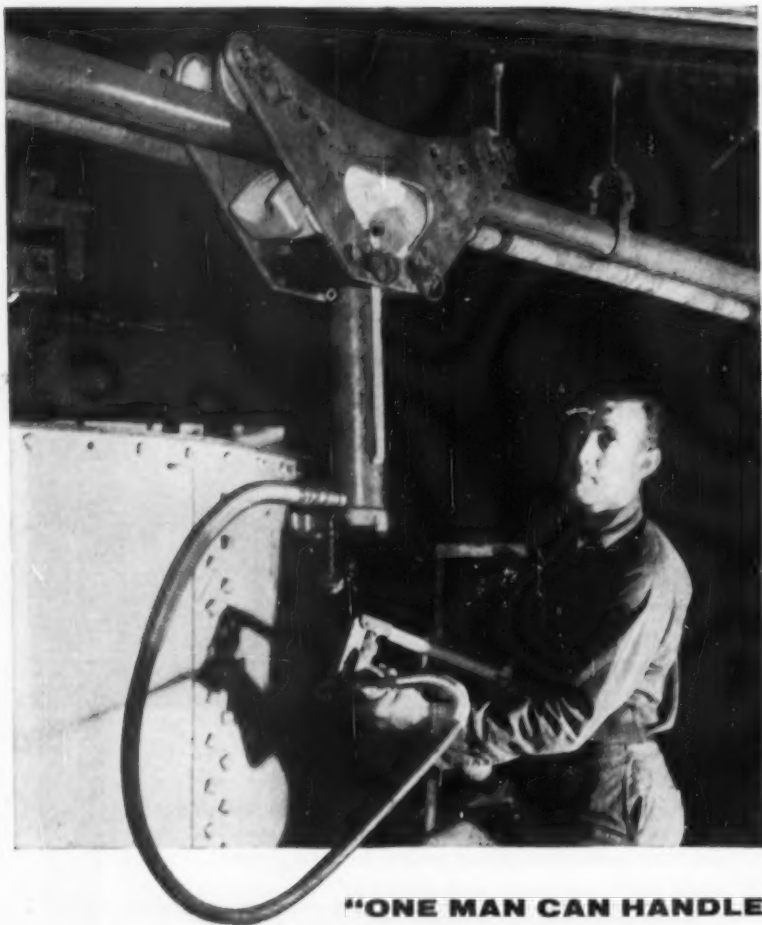
Curtis Lighting, Inc., Dept. D-4
6135 W. 65th St., Chicago 38, Illinois

Send specifications on Curtis 6000 Industrial Series luminaires to

Name _____

Address _____

City _____ Zone _____ State _____



**"ONE MAN CAN HANDLE
ALMOST ANY CONDUIT PROBLEM
with a portable Greenlee Hydraulic Conduit Bender,"**

says R. A. Branford, Chief Electrician, C. F. Church, Monson, Mass.

Pictured above is another unusual conduit bending job being performed by the No. 880 GREENLEE Lightweight Hydraulic Bender. It's being used to form offsets in an existing conduit and "raise it," so that new machinery can be moved under it without interfering with electrical service.

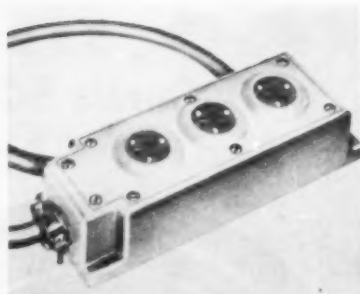


In reporting on this work at C. F. Church Division of American-Standard, Monson, Mass., Chief Electrician R. A. Branford says that the GREENLEE Bender saved eight hours of work and about \$25 in fittings, plus large savings in the form of non-interruption of plant operations. You'll find many timesaving and

moneysaving advantages in having a GREENLEE Bender on your jobs, too. Portable, one-man carried, one-man operated. *Makes full 90° bend with one ram stroke.* Quickly makes the exact bends you need in all sizes of conduit and pipe from 1/2" to 2". Entire unit is easily used on the floor, on a bench, or aloft as shown above. Easily operated with hand pump or can be teamed with a GREENLEE power pump for fast production jobs. Write for complete details.



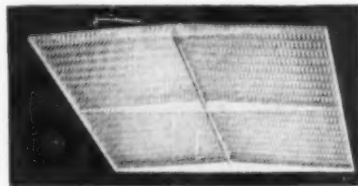
GREENLEE TOOL CO., 1752 COLUMBIA AVENUE, ROCKFORD, ILL.



Outlet Box (36)

A new oil-proof portable multiple outlet box, called Multi-Tap, for motion picture and photography studios, for aircraft plants and for industrial assembly lines. It is made from a new "Safety Yellow" Neotex, a synthetic rubber compound impervious to oils, greases, and most chemicals. It is non-breakable and can be used on fine surfaces and finishes. All metal parts and screws are recessed in heavy-duty, no-smear Neotex. Multi-Tap is available in all popular types of receptacles: parallel, tandem, crow-foot, "U" blade, and Turnex.

Daniel Woodhead Co., 15 North Jefferson St., Chicago 6, Ill.



Primalume Controlens (37)

A new Primalume Controlens for installation in 2-ft fluorescent source modules. No. 6024 employs conical prismatic elements formed in a concave shape and having both longitudinal and transverse fins. It affords troffer installation, luminous ceiling panels or complete over-all ceilings which produce high footcandle installations free from glare. No. 6024 accents the modern decorative trends in offices, stores, showrooms, schools, auditoriums and a wide variety of other public areas.

Holophane Company, Inc., 342 Madison Ave., New York 17, N. Y.

Lighting Fixture (38)

The new Decorative Opalite is a drum-shaped fixture, and features slotted pierced brass or copper crowns. Crowns are designed to go with the brass and copper accessories currently popular in kitchens, corridors, stairwells, and lobbies in the home, as well as schools, hospitals, stores, etc. Pure white opal glass diffuser provides glareless lighting and Torsionite spring enables bowl



GENERAL ELECTRIC
EMT
FOR EASIER
WIRE PULLING

No snagging...and it's so easy to pull through!

For greater speed in your wiring jobs get the advantage of easier wire pulling with General Electric EMT. It has a low-friction interior surface produced by a special baked-on Glyptal* coating. And the exclusive continuous induction weld means no splits—and no burrs to snag and tear insulation.

In addition, General Electric EMT is easier to bend because of its uniform cross-section—it does not

tend to kink or flatten. Another convenience is the color-coded binding tape used to bundle EMT. You can identify the size instantly—at a glance. General Electric EMT is available throughout the country from G-E Construction Materials distributors. For more information see your distributor or write Section C69-1218, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company

Progress Is Our Most Important Product

GENERAL  **ELECTRIC**





Servisafe POLES...

THE EASY WAY TO SOLVE LUMINAIRE MAINTENANCE PROBLEMS

Relamping and cleaning a pole-mounted luminaire is an easy one-man job... *if all work is done at ground level!* It also is the most efficient and economical means of maintaining inaccessible lights.

Only Thompson "Servisafe" Poles eliminate climbing hazards, electrical dangers and lost time in the maintenance of pole-mounted luminaires. They permit one man to service lights quickly and safely in any kind of weather... help maintain peak lighting efficiency at minimum cost.

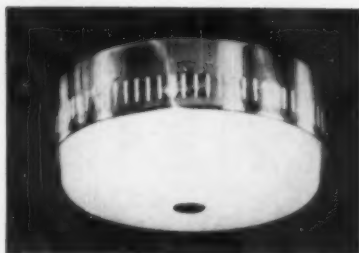
"Servisafe" Poles are available in single and double-arm models... steel or aluminum construction... a variety of styles.

FOR DETAILS AND PRICES, write for Bulletin
WHP-54... or call SUPERIOR 1-7626.



THE THOMPSON ELECTRIC CO.
1157 POWER AVENUE • CLEVELAND 14, OHIO

THE TE



to be pulled down with fingertip pressure and suspends it for quick bulb changing and cleaning. Unit is 4½ in. deep. Aluminum construction is corrosion resistant even when used outdoors. Temperatures on ceiling and within outlet box are kept within the safety level through the use of fiberglass insulation within the ceiling pan. An aluminum oil-asbestos sheet laminate attached to surface of pan disperses heat and also reflects light through diffuser.

Lightolier, Inc., 346 Claremont Ave.,
Jersey City 5, N. J.



Floodlight (39)

An all-purpose outdoor floodlight, named "Homelight", is particularly suited to outdoor holiday lighting, garden and patio lighting, protective lighting and in driveways, farmyards, tool sheds, lawns. It doubles as holder for sunlamps and heat lamps and can be used in many other indoor applications. Construction is of heavy-duty, cast aluminum, and it is supplied with lawn spike and wall bracket, 6-ft SJO cord and weatherproof plug, and porcelain socket and seal. It is weatherproof and UL approved.

Stonco Electric Products Company,
333 Monroe Ave., Kenilworth, N. J.

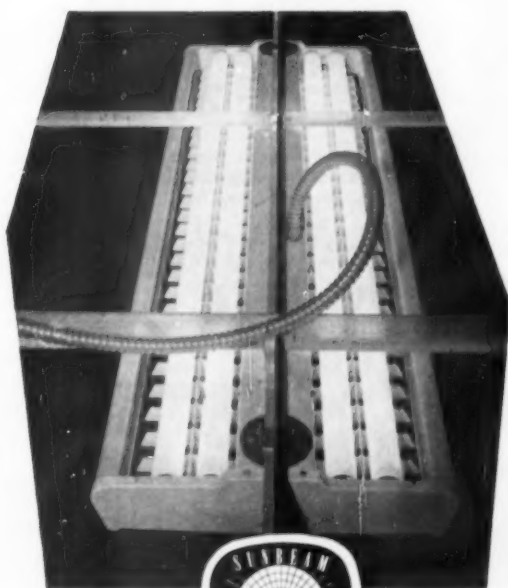
Emergency Lighting Unit (40)

A redesigned automatic emergency lighting unit designed primarily for industrial plants, laboratories, hospitals, hotels, institutions, theatres, etc. Unit is powered by a storage battery built into the portable set. A trickle charger automatically maintains the charge of the battery. A built-in hy-



**PUT YOURSELF
IN THIS PICTURE AND
SAVE MONEY**

Flower Street Building, Los Angeles • Zamboni Bros., Electrical Contractors



Write for bulletin "CV".



*patent pending

CONTRACTORS for the lighting installation shown above were astounded to learn that these Sunbeam Visionaires® could be mounted and connected at the rate of about 6 minutes each — resulting in great savings in labor costs.

ARCHITECTS are delighted because for the first time they can plan for "surface" mounted lighting directly on suspended ceiling systems — with fixtures either parallel with or diagonal to the ceiling grid runners.

This new installation device (CSM7)* is the product of Sunbeam Lighting design ingenuity — planned with you in mind to increase the flexibility of fine Sunbeam Visionaires® and to help cut installation costs.

No tools are required — the hangers are simply clipped on the runners and remain in position as the fixtures are lifted for attachment. A few twists of the wing nuts hold fixtures in place. Before "cinching up," the fixtures may be slid along the runners to the exact location required. Ask your local Sunbeam lighting representative to demonstrate the new money saving (CSM7)* hanger.

SUNBEAM LIGHTING COMPANY
777 East 14th Place, Los Angeles 21, California

QUAD

Offers the Latest
Development in a
QUICK
Connecting and Disconnecting
SOCKET
FOR INDUSTRIAL REFLECTORS



IT'S THE

QUAD EASY TACH

NOW the complete line of QUAD REFLECTORS can be equipped with EASY TACH, a socket with simplicity of design that makes quick connecting and disconnecting of lamped reflectors very easy.

Any size or style of QUAD socket type reflector with hex hole may be converted to the quick connecting and disconnecting type by substituting the new EASY TACH socket for the regular one-piece 1/2-inch medium or mogul socket.

This new socket feature will be a great advantage in making your reflector sales move at a faster pace.

Write for complete descriptive literature.



drometer indicates the state of the battery at a glance. To install, plug in to any ac circuit. Lights are sealed beams of 100 C.P. and will provide continuous light for ten hours.

General Scientific Equipment Co.,
7516 Limekiln Pike, Philadelphia 50,
Pa.



Saturable Reactors (41)

A complete line of saturable reactors ranging in output from .3 to 500.0 kva, for manual or automatic control of power to a load. This "transformer-type" of device is ideal for stepless control of electrically heated equipment, reduced voltage in ac motor starting circuits, and loading reactors for test boards. By changing the magnetic characteristics of the reactor core, the impedance can be varied by means of a direct current control winding. Reactors are in an enclosed case with removable panels for installation and wiring or open for mounting in a control panel. Each reactor is tested to meet or exceed NEMA standards. Bulletin 500 is available.

Hevi Duty Electric Company, Milwaukee 1, Wis.

Compression Sleeve (42)

All-aluminum Squeez sleeve, compression joint, for all combinations of conductors copper, aluminum and ACSR from size No. 10 through size

QUADRANGLE MFG. CO.

32 S. PEORIA ST.

CHICAGO 7, ILL.



"Mr. Owner, has your building ever suddenly gone dark?"

(a yes answer to this question means you've got a red-hot prospect for Exide Lightguards)

Deep down inside, most businessmen and institution managers know they need Exide Lightguard® equipment. But an actual loss of electricity turns them into red-hot prospects fast.

One large department store lost its lights suddenly. Within minutes, over \$50,000 worth of merchandise was stolen. The next day they bought emergency lighting equipment for the entire store. Risks include not only theft, but panic, injury, damage.

HERE'S YOUR MARKET: stores, office buildings, schools, theaters, factories, laboratories, restaurants and institutions. Get in on the ground floor. Become an Exide dealer. Exide Lightguards are foremost in the field for quality and acceptance. Send the coupon today.

When power fails and lights go out, Exide Lightguard emergency lighting units go on—instantly and automatically. Plug into regular outlets. Built-in charger. Batteries last for years. Several models.



Exide® Industrial Division

The Electric Storage Battery Company, Philadelphia 2, Pa.

Send details on Exide Lightguards

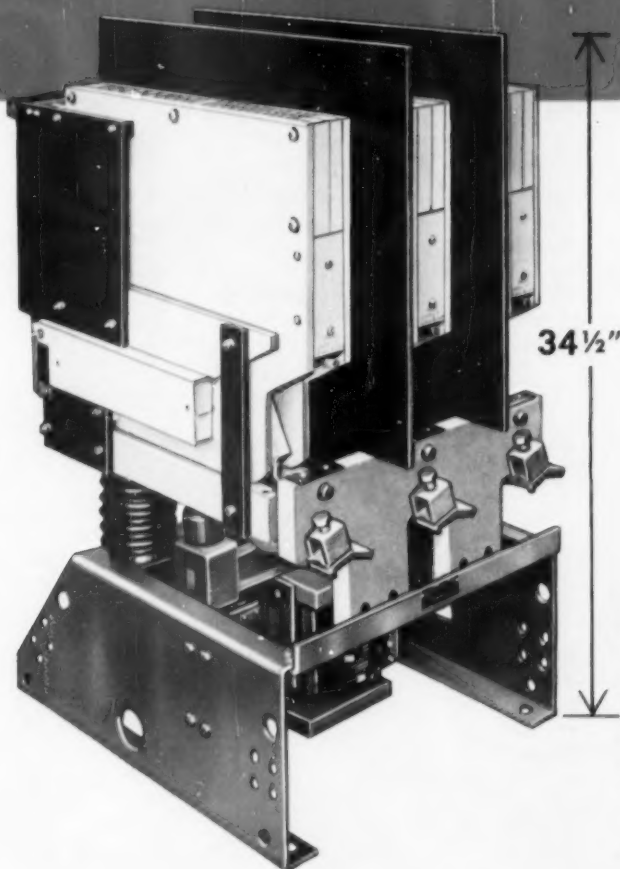
Name

Street

City Zone State

My business is

NEW Development **In High Voltage** **Air Break Contactors**



Here's a brand new high voltage contactor . . . incorporating the same design simplicity on which the "Quality" reputation of Allen-Bradley motor control is based. Like the Allen-Bradley control having a rating of 600 volts a-c maximum, the new 5000 volt air break switch is of the solenoid type, has only one moving part, and thus is assured a mechanical life of millions of operations. The silver alloy contacts are also double break, and remain in perfect operating condition irrespective of the frequency of operation, or whether used in reversing or jogging service. Available for 2500 and 5000 volts. Interrupting capacity 50,000 kva.

NOTE THESE FEATURES—

- **ONLY ONE MOVING PART**—Simple solenoid design eliminates all pins, pivots, and flexible "jumpers."
- **COMPACT**—Unique design and development in new materials made possible a switch of unusually small size.
- **DOUBLE BREAK, SILVER ALLOY CONTACTS**—Require no maintenance. There are no flexible jumpers. Straight up-and-down motion assures good uniform contact pressures.
- **EASY ACCESS FROM FRONT**—Easy to inspect. Routine maintenance operations require no special tools.
- **FASTER ARC SUPPRESSION**—Double break contacts, new blow-out design, and novel arc chute assure rapid arc extinction.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.



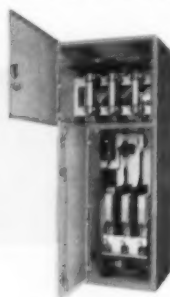
A new line of high voltage starters

(UP TO 5000 VOLTS)

as up to date
as the new
**Allen-Bradley
Air Break
Contactor!**



Bulletin 966 high voltage air break across-the-line type synchronous starter. Picture at left shows unit with doors to high voltage fuse and high voltage contactor compartments open.



Bulletin 1159 across-the-line starter for high voltage squirrel cage motors.

Bulletin 1172 reactor type high voltage squirrel cage reduced voltage starter.

Starters are shown with doors to fuse and high voltage contactor compartments open. Note the bus bars at the top of the cabinet and the plate on the side of the cabinet for connection with similar buses in adjacent starters. This is an optional feature.

Using the new air break high voltage contactor as the "base," Allen-Bradley has available a complete line of full voltage and reduced voltage starters for all types of motors up to 5000 volts.

For standard squirrel cage and synchronous motors, the full voltage starters can be furnished for either non-reversing or reversing service. In the reduced voltage construction, both squirrel cage and synchronous starters are of the reactor type. These starters can also be supplied for reversing service. In addition, the Allen-Bradley high voltage starters can be built for use with part winding and slip ring motors.

All Allen-Bradley high voltage starters are equipped with current limiting fuses and a front operated disconnect switch which is interlocked with not only the doors of the enclosure but also the high voltage contactor. All starters have an interrupting capacity of 150,000 kva at 2300 volts and 250,000 kva at 4600 volts.

Overload relays with current transformers provide continuously reliable motor overload protection. The maximum rating of this new line of starters is 1500 hp, 2300 volts; 2500 hp, 4600 volts. These ratings for synchronous motors are at 0.8 P.F.

Because of the simplicity of design of the Allen-Bradley high voltage contactors, having only one moving part, and also using double break, silver alloy contacts which are always in perfect condition, these starters are recommended for applications requiring frequent operations. These are truly "heavy-duty" starters.

Allen-Bradley
also builds a
complete line of
oil-immersed
high voltage
control

ALLEN-BRADLEY MOTOR CONTROL

QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada — Allen-Bradley Canada Ltd., Galt, Ont.

Write for
Bulletin
describing
this new
line of
Allen-Bradley
high voltage
control



BIDDLE *Instrument News*

Biddle Motor and Phase Rotation Tester (Dual Purpose)



With it you can . . .

- Determine the direction of rotation of electric motors before they are connected to the line.
- Determine the phase rotation or sequence of energized power circuits.

Here is a positive means for determining which motor leads must be connected to certain conductors of a supply system to insure that the motor will rotate in a prescribed direction when energized.

This device will permit the electrical contractor or industrial maintenance electrician to permanently connect and tape the terminals of the motor being installed, without having to first energize the motor by a temporary "hook-up" from a power source, if available, to determine its rotation.

Housed in a sturdy oak case $12\frac{1}{4}'' \times 8\frac{1}{4}'' \times 4\frac{1}{4}''$ this compact unit weighs approximately 10 pounds and is supplied complete with 3 line and 3 motor leads which store in the compartments either side of the instrument panel.

For complete details write for **BULLETIN 80-ECM**

SEELY MOTOR TESTER

for measuring the electric resistance of a-c energized windings

The Seely Motor Tester circuits provide a simple means of measuring the electric resistance of a-c energized windings while at the same time observing winding temperatures under actual load conditions.

Since its conception, 7 years ago, this equipment has proved very useful for determining the winding temperature of induction motors. It has been particularly effective for testing hermetic refrigeration motors, since thermocouples cannot be readily used and since these motors cannot be shut down during test for resistance readings, without disrupting the test.



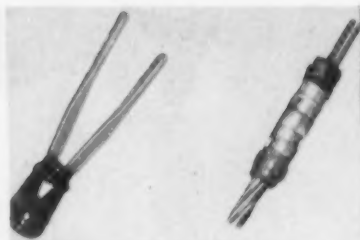
The latest circuit enclosure for measuring resistance of a-c energized windings. The circuit is rated at 20 amperes, 250 volts, 60 cycles, single-phase or polyphase, 0.2 to 100 ohms.

For full **INFORMATION** and **PRICES** request **BULLETIN 70-ECM**

JAMES G. BIDDLE CO.

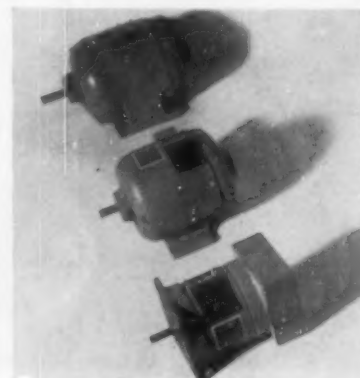
• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.



No. 2. Compression sleeves are used for service entrance connections, and coded by means of colored plastic caps over each end. Five clear colors denote the different sizes and there are 15 different coded sleeves to provide the size and type conductor combinations. For use with this new sleeve, there is a new No. 10-XPJ Squeeze tool. It is available either with handles coated with a bright orange vinyl plastisol which affords insulation should it be used for secondaries, or with handles painted a bright orange.

Reliable Electric Co., 3145 Carroll Ave., Chicago 12, Ill.



Torque-Brake Units (43)

Three compact torque-brake units giving a wide range of speed-torque characteristics. Designed to provide continuous tension, these motors are especially applicable to wire winding. Torque can be decreased by reducing the applied voltage or increased if intermittent ratings are permissible in the application. Illustrated at top is the 5830 frame, continuous duty, open torque-brake unit. Diameter 6 in., length 9 in. Center unit is 5220 frame, continuous duty, open torque-brake unit. Diameter 5 in., length 7 in. Bottom 3520 frame, continuous duty, totally enclosed unit. Diameter 4 in., length 5 in. All three are 220-volt, 3-phase, 60 cycle.

B. A. Wesche Electric Co., 1622 Vine St., Cincinnati 10, Ohio.

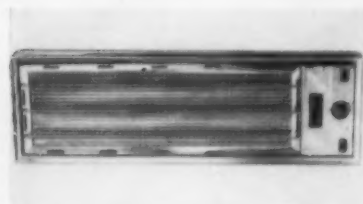
Emergency Lighting Unit (44)

An automatic self contained "Sentry-Lite" Model "J55" for emergency use in large areas. This lighting unit is topped by three 5,000 candle power sealed beam lamps which



will provide illumination for six hours. It features an automatic re-charger operating on standard electrical power to keep the battery up to peak capacity. Test panel on front includes a momentary switch for test as to function, ac fuse, toggle switch to cut off light and a pilot light indicating unit is functioning. Overall dimensions 8 by 10 by 16 in.

Sentry-Lite & Battery Div., Hobby & Brown Electronic Corp., 237 Sunrise Highway, Rockville Centre, N. Y.



Heater (45)

New No. 2200 electric bathroom wall mount heater operates on 120 volts ac. Ra-Grid glass pane furnishes 700 watts of radiant heat. Gold-finished aluminum control panel has built-in night light with off-on switch, thermostat, pilot light, and 120-volt convenience outlet. Made of extruded anodized aluminum, with outer section silver, inner section gold. It is rust and tarnish proof.

Allied Precision Industries, Inc., 425 Stevens St., Geneva, Ill.

Flush Mounted Case (46)

A new flush mounted case for housing several series of Intermatic time switches. Case carries UL approval. It is available for use with TS60 standard on-off switches, the TS66 "Skipper" series, which permits operation on selected days, and the T670 series for short interval timing of 5 to 60 minutes. Case is made of heavy duty formed steel in grey crackle finish with hinged door that may be had with or without a key lock. Five knockouts, one on each side and three on bottom, provide access to terminals. Bulletin No. 136 is available.

International Register Co., 2620 W. Washington Blvd., Chicago 12, Ill.

ONLY ELECTROMODE Offers so much! in Automatic ELECTRIC HEAT



ALL YOUR REQUIREMENTS FROM ONE RELIABLE SOURCE
COMPLETE OR SUPPLEMENTARY HEAT

FOR HOME

✓ BASEBOARD HEATERS

Low-Level Perimeter Heat

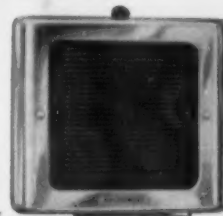
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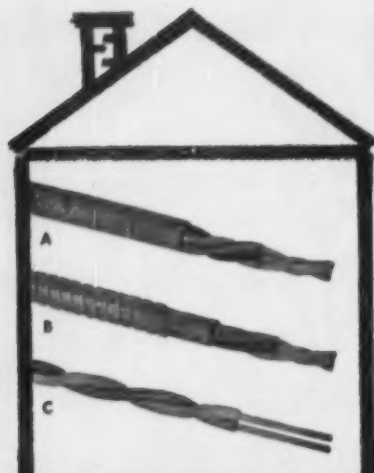
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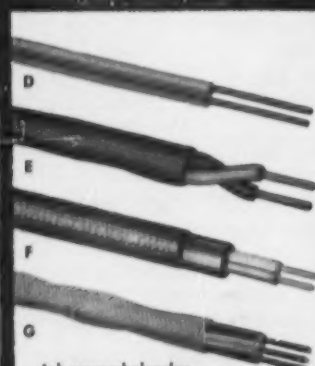
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- G enameled asbestos



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famous Royal blue and orange spools

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ELECTRIC CORPORATION
Pawtucket, Rhode Island

Product Briefs

(47) Birnbach Radio Co., Inc., New York, N. Y., has introduced a new thin wall Birflon Teflon tubing.

(48) CMG Industries, Inc., Laramie, Wyo. has announced a new electrical extension duct, made of rubber, designed for offices and homes. . . . (49) Mini-Test, a pocket-size voltage tester, will check unknown voltages from 65 volts to 800 volts ac and dc. It is manufactured by Omega Products, Chicago, Ill. . . . (50) Pattern Products Co., Union, N. J., has introduced a new fluorescent tube changer. The all-aluminum model can be used as a 4- or 8-ft unit and can reach up to fixtures as high as 15 ft above the floor.

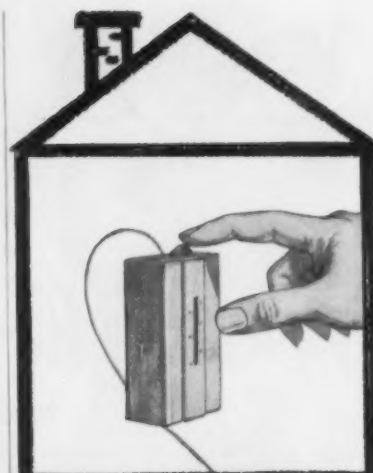
(51) Hotwatt, Inc., Danvers, Mass., has developed a complete line of ceramic-body heating cartridges. . . . (52) A new 2-in-1 silicone glass cloth electrical tape, suitable for Class H insulation, has been developed by the Permacel Tape Corporation, New Brunswick, N. J. . . . (53) Epoxy resin wire markers that resist oil and heat are a new development of the W. H. Brady Co., Milwaukee, Wis.

(54) International Instruments Inc., New Haven, Conn., has announced the production of a new line of miniature ac voltmeters featuring expanded scales. . . . (55) Dura Electric Lamp Co., Inc., Newark, N. J., is now manufacturing fluorescent lamp starters made with ceramic condensers. . . . (56) A one-man operated trencher for electric cable, gas lines, water lines, telephone cables, sprinkling systems, etc. has been announced by Brown Manufacturing, Inc., Woodbine, Iowa.

(57) Blonder-Tongue Laboratories, Westfield, N. J., is now supplying two new solderless connectors for a wide variety of coaxial cables. . . . (58) A new instrument, called the Doyleite Switchcheck, which indicates the open or closed condition of a switch, has been developed by Doyle Design & Machine Co., Rochester, N. Y. . . . (59) Enflo pressure sensitive cementable Teflon tape, in practically any desired thickness from .0005-in. to .060-in. and in widths from 1/4- to 12 in. has been announced by the Enflo Corp., Pennsauken, N. J.

(60) A new outdoor color lighting kit for use with 75- and 150-watt sealed beam projector lamps has been announced by Stonco Electric Products Co., Kenilworth, N. J. . . . (61) A plastic anchor, suitable for the fastening of light electrical equipment, signs, office and home fixtures, is being offered by the U. S. Expansion Bolt Co., York, Pa. . . . (62) Star Expansion, New York, N. Y., has announced the production of a complete line of Rotrtwist spiral fluted carbide masonry drills.

(63) A complete line of motor testing dynamometers featuring the new electronic tachometer, has been announced by Magtrol, Inc., Buffalo, N. Y.



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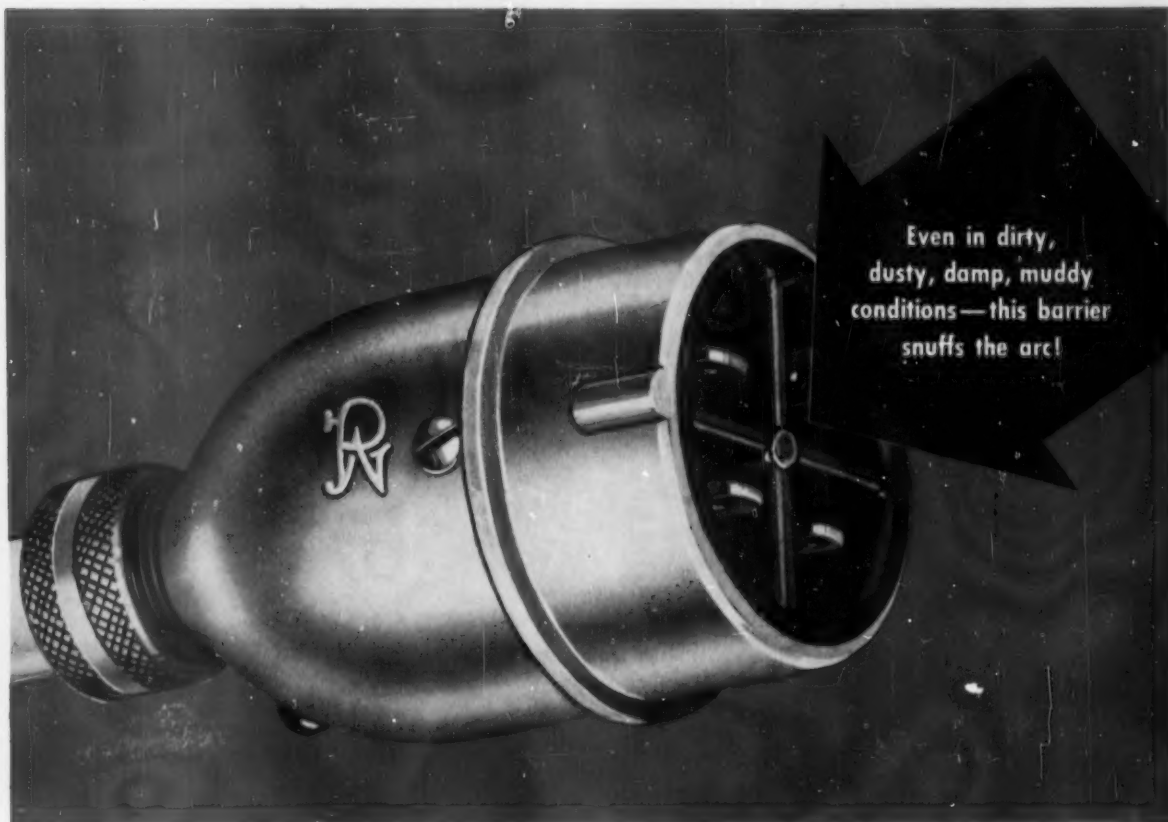
Whatever the job . . . new installations, rewiring, or repairs . . . decide NOW to specify ROYAL ELECTRIC Thermostat Cable for your fall and winter requirements. ROYAL dependability is built into every foot, to meet your highest standards and to insure trouble-free service and satisfied customers.

Available from your wholesaler, in all types and sizes. Order NOW . . . and specify ROYAL!



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snuffs the arc!

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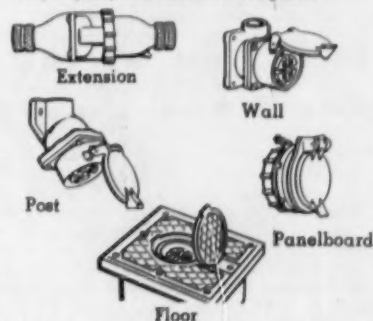
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UL Listed—600 Volts AC, 250 Volts DC
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THE ULTIMATE, TAPERED WIRE CONNECTORS
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Screw them on—like a nut on a bolt. "Wire-Nut" Connectors twist, thread, grip with spring tension and insulate—make positive pig-tail splices in one operation! Connections are shake-proof, pull-proof, actually stronger than the wire itself. Precision molded, high dielectric phenolic shell covers all bare wires, never shorts out. UL approved as pressure connectors for branch circuit wiring.



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WIRE CONNECTORS



Make quick, positive connections with a screwdriver. Merely insert wire ends into the brass sleeve, tighten set-screw and screw on precision molded phenolic shell. Ideal for use where visual inspection of joints or frequent circuit changes are required. New compact shape and extra long skirt provides highest dielectric protection. UL approved sizes for general and appliance wiring.

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BULLETINS CATALOGS and

(64) MOTORS. Bulletin 51B8440A describes design features and applications of the Synduction motor. Allis-Chalmers Mfg. Co.

(65) TERMINAL BLOCKS for a wide range of wiring needs are detailed in 8-page bulletin 556. Curtis Development & Mfg. Co.

(66) DIMMERS of the non-interlocking type for controlling auditorium or single-room lights where only a few circuits are involved are the subject of 16-page bulletin L755N. Superior Electric Co.

(67) MOTOR CONTROLS. Complete line of general purpose controls is covered from the standpoints of what it is, how it works, and where it can be used. Bulletin GEA-6372. General Electric Co.

(68) SPEED REDUCTION. Construction features of integral gear motors, speed reducers with separate motors, and speed reducers alone are detailed in 12-page bulletin 191-50M. Sterling Electric Motors, Inc.

(69) PANELBOARD. Bulletin 1-160, 16 pages, describes design and installation benefits of new StA-Breaker line of plug-in molded case circuit breakers and bus enclosures. Federal Pacific Electric Co.

(70) SQUARE LENS LITES for incandescent lighting applications are detailed in a 4-page folder covering photometric data and design data. Corning Glass Works.

(71) WIRING BOXES AND TROUGHS meet JIC specifications for moisture- and dust-proof installations. Bulletin BT-56, 2 pages. Eliza Metal Products Co.

(72) ILLUMINATED CEILING. Folder 121-Lu, 4 pages, describes lighting and mechanical advantages of the Lumenated Ceiling. Thermotank, Inc.

(73) TROLLEY BUSWAY SYSTEM employing high strength aluminum alloy conductors available in capacities to 300 amps at 575 vac and 250 vdc. Lec-Trol-Feed bulletin, 4 pages, includes specifications and illustrated descriptions of components. Delta-Star Electric Division.

(74) **MOTOR CONTROLS.** Operational, dimensional and price data on controls are presented in the 132-page indexed Handy Catalog. Allen-Bradley Co.

(75) **INSULATING MATERIALS** are detailed in booklet B-1050 covering the complete line of tapes, fabrics and treated papers. Westinghouse Electric Corp.

(76) **PROTECTIVE DEVICES.** Method of coordinating molded case breakers with current-limiting fuses for protecting LV feeder circuits against fault currents up to 100,000 amps rms is described in 8-page bulletin GEA-6569. General Electric Co.

(77) **MOTORS** with Multiguard protection offer the advantages of totally enclosed motors without the higher cost by sealing all coils in plastic. Bulletin SB-1345, 4 pages. Lincoln Electric Co.

(78) **CIRCUIT BREAKERS** operating on the hydraulic-magnetic principle are detailed in 20-page bulletin 3411. Heinemann Electric Co.

(79) **LUMINOUS CEILINGS.** Construction details, available diffusers, characteristics of various translucent ceiling types are presented in 4-page folder. Luminous Ceilings Inc.

(80) **TRANSFORMERS.** Two bulletins. GED-2767A is a 32-page compendium of data on autotransformers, control-panel and machine-tool transformers. GEA-5754C features voltage stabilizing transformers in its 16 pages. General Electric Co.

(81) **RESIDENTIAL SERVICE CENTERS** featuring one or two 70-amp 2P breakers as mains available in three basic models. Bulletin PAN-7, 6 pages. Bulldog Electric Products Co.

(82) **RESIDENTIAL LIGHTING** equipment for every style of home and every living area are illustrated in new 51-page catalog. Jay Lighting Mfg. Co., Inc.

(83) **LINE TOOLS**, designated MD4 and MD5 Hytools will install compression connectors on copper, ACSR, and AAAC cables from #10 through 1/0. Burndy Corp.

(84) **INSULATORS.** Catalog 56 covers complete line of porcelain insulators, hardware and new BIL indoor switch and bus supports. Victor Insulator Division.

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With the "E-Z" it's easy to strip the outer sheath and web, then the inner conductors (2 or 3 wire 12 or 14 ga.) from non-metallic sheathed cable — without cutting, nicking or other damage to the wire ends. The "E-Z" Automatic is lightweight yet durable all-steel construction for long, heavy duty service life. Available in 5 other models for stripping various types of wire from 8 through 26 ga.



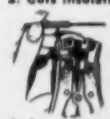
1. Clamps wire



2. Cuts insulation



3. Strips it off



4. Lever automatically stops return of arms until wire is removed.

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A practically designed mechanic's tool for quickly and easily ripping the outer sheath from non-metallic covered cable up to 1/2" O.D. Faster—just insert the cable, set blade depth and rip away. Rigid frame and cradle assure straight cut. Replaceable steel blade; durable aluminum rip-grip for speed and safety.

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If your regular electrical wholesaler stocks certified CBM ballasts for over-the-counter sale, he can give you an immediate, *free* replacement for any defective in-warranty Sola fluorescent ballast you bring in.

There's absolutely no cost to you, no delay, no red tape or obligation of any kind. Your regular local wholesaler is able to provide this free service through a special arrangement with Sola Electric Co. Even if he does not stock Sola ballasts, he can give you an *immediate* replacement. Sola has authorized him to give you an equivalent certified CBM ballast of another make if necessary!

Feel free to take advantage of this free service now offered by leading electrical wholesalers all over the country. Your customers will appreciate the fast replacement service you can now give them in those rare instances when a Sola ballast fails.

The quality standard of Sola ballasts

The Sola Ballast Service Plan is made possible because Sola ballasts have an exceedingly low failure ratio. Less than 14/100-of-1% of *all* Sola ballasts fail in-warranty, and less than 9/100-of-1% of Sola Rapid Start ballasts fail in-warranty. This very low failure ratio is due to Sola's policy of maintaining exceptionally high standards of quality in engineering and manufacturing.

Here's how the plan works



1. Should you find a Sola ballast which has failed within the warranty period, take it to the nearest electrical wholesaler who is a qualified Ballast Service Center. Most likely this will be your regular wholesaler if he stocks certified CBM ballasts for over-the-counter sale. He will check the warranty date stamped on the ballast cover.





2. If the ballast failed within two years of this warranty date, your wholesaler will replace it *free*, with another Sola ballast if he stocks them. If not, he refers to a replacement guide provided by Sola, to find an equivalent certified CBM ballast of another make which he stocks.



3. Your wholesaler will immediately give you a new Sola ballast or the equivalent certified CBM ballast replacement. There is absolutely no charge to you, no red tape, no delay. You merely sign a receipt and take the replacement ballast with you.



4. Because the replacement was made through your local wholesaler, no time was lost in ordering or waiting for delivery. Your customer appreciates the fast service you are able to give him in restoring his fixture to perfect operating order.

FREE Sola Cross Index Ballast Replacement Guide from your local electrical wholesaler

Most likely, your regular local electrical wholesaler is participating in Sola's Ballast Service Plan, even though he does not stock Sola ballasts. If he stocks certified CBM ballasts of any make for over-the-counter sale, he can participate in the plan. He will display a Sola "Ballast Service Center" emblem in his place of business.

Ask him for a Sola Cross Index Ballast Replacement Guide. This valuable chart lists Sola ballasts and certi-

fied CBM equivalents. It also shows you how to determine if a Sola ballast is in-warranty. The chart folds to 8½" x 11", and is pre-punched to fit your standard 3-ring notebook. If your local wholesaler has none of these charts on hand, remind him that he can get a free supply from Sola Electric Co. for distribution to his customers. If you prefer, you can get your Replacement Guide by filling out and mailing the coupon below.

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Bishop 2-1414

TO: SOLA ELECTRIC CO.

4633 West 16th St., Chicago 50, Ill.

Please send me, without any cost or obligation, the "Sola Cross Index Ballast Replacement Guide."

My name _____

Company _____

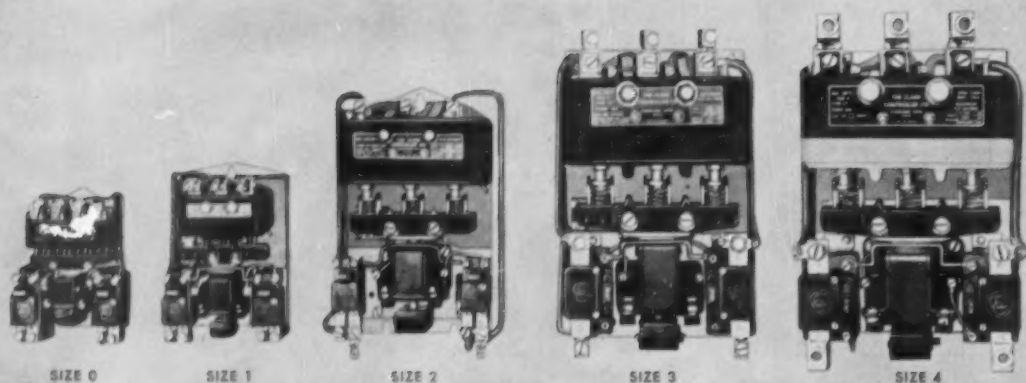
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City _____ Zone _____ State _____

My Regular Wholesaler: _____

(Wholesaler's Name)

(Wholesaler's Address)

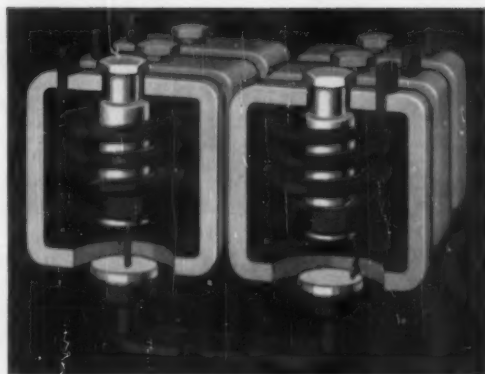


CLARK Type "CY" Starters now available in sizes

0 to 4

With the addition of the new size 4, the famous CLARK line of Type "CY" Magnetic Motor Starters now comprises the full range from 0 to 4. This means that Clark starters of the proven "CY" design incorporating vertical lift magnets are now available for more than 95% of industry's AC requirements. For installations requiring sizes 5 and larger, Clark will continue to supply dependable clapper-type starters.

Clark Type "CY" starters have many outstanding design features for more dependable operation, less maintenance and longer life. For example—rugged construction with twin-break contacts means more trouble-free service . . . contacts can be inspected without tools . . . movable and stationary contacts can be removed and replaced quickly, coils changed and the entire magnet assembly removed—all from the front—without special tools and without removing the starter from the cabinet or panel.



Revolutionary arc-quenching principle is an exclusive feature of all Clark Type "CY" starters sizes 2 and larger. It combines twin-break contacts with strong multi-turn magnetic blowouts which force the arc to rotate—alternately lengthened and confined—so that it moves continuously from a hot to a cold spot on the contact surfaces. This practically eliminates metal build-up or pitting and greatly increases contact life.

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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

3-Phase Motor On 1-Phase Line

QUESTION A31—Is there any way I can run a 5 hp, 3-phase, squirrel-cage induction motor on a single-phase supply? If it will help, I also have an assortment of small single-phase machines and polyphase machines.—H.M.

ANSWER TO A31—A 10-hp, 3-phase motor should be placed in parallel with the 5-hp motor in question. A ½-hp single phase motor should be mechanically coupled to the 10-hp, 3-phase motor. The ½-hp, single phase motor is started by means of a double throw switch. As soon as the 10-hp, 3-phase machine is brought up to speed the double throw switch is thrown to the other, or running side, which connects the line to two of the 10-hp, 3-phase motor's leads.

The 5-hp, 3-phase machine will now be supplied with a rotating field because of the 3-phase currents flowing between the two machines, and will therefore continue to run and deliver power to its load.—V.P.

ANSWER TO A31—My answer to your question, since you seem to have a surplus of 3-phase motors and only single-phase power, is to scrap the 3-phase motors and purchase single-phase motors of the required size, with the cost amortized over a two-year period.

But, if you are interested in running the three-phase motor on single-phase power, any phase displacement device will enable you to do this, preferably a capacitor. Connect the two line wires of the single-phase power to any two terminal wires of the three-phase motor and connect a capacitor between the third terminal wire of the motor and either single-phase line wire. This creates the phase displacement that is necessary for a rotating magnetic field to produce starting torque.

The capacitor size is calculated by the formula:

$$C \text{ in microfarads} = \frac{2,650 \times I}{V}$$

Where V = motor rated voltage and I = motor full load current rating.

Remember, of course, that if the capacitor is to remain in the

circuit, it must be of the oil-filled type, and its voltage rating must exceed the motor voltage times 1.414.—J.M.

Short Circuit On Generator

QUESTION B31—What would happen if a 3-phase short circuit was applied to the output leads of a 3-phase ac generator carrying load? The short circuit is applied at the output terminals of the generator. Would it stop, increase speed or remain the same as if it were carrying load?—J.B.K.

ANSWER TO B31—How the speed would change and by how much is dependent to a large degree upon what the generator is being driven by. The short circuit is, in effect, a very great overload. For the usual cases the speed would undoubtedly decrease, the generator might even stop. For example, an abrupt heavy load like this would be likely to stall a gasoline engine, if one were being used to drive the generator.—P.S.

ANSWER TO B31—On larger generators it could be disastrous to the one applying the short circuit and to those nearby, or even fatal unless essential safety precautions were taken. The generator windings could be burnt up. There would be two different actions taking place. The generator would slow down. If it had automatic speed control it would attempt to regain normal speed. If the overload protection was not bypassed, the overload relays would operate and open the circuit breaker. Also the field circuit would be opened and if the valves on the turbine or engine were electrically operated they would be closed.

Of course, the generator you have reference to may not have this protection or it may be bypassed by the short circuit. In that case the generator would be very badly damaged. The best advice is not to short circuit the generator.—E.B.

ANSWER TO B31—A 3-phase short circuit at the output of an alternator would be similar to a sudden, terrific overload. While the exact results would depend upon the type of alternator, the prime mover,

and the size of the machine, you could expect the following:

1. There would be an instantaneous attempt to slow down. A small engine-driven machine would probably stall, a large turbine machine would lose synchronism, and mechanical damage to generator coupling and alignment could result.

2. The increase in current would be so great that magnetic force would probably throw out the generator coils. Insulation would be charred, connections melted, and serious mechanical damage done.

For a single generator system a solid short circuit at the generator terminals would be one of the worst locations, as the current magnitude would be limited only by the internal generator impedance.—D.H.N.

120 Volts vs 277 Volts For Lighting

QUESTION C31—I have estimated the electrical work for several large warehouses recently and have noted in each case that the lighting is at 120/208-volts, 3-phase, 4-wire. The service is brought into the building at 13,800 volts to a unit substation. Here the transformation is to 277/480 volts, 3-phase, 4-wire. The power requirements are taken off at 480-volts. For the lighting, 480-volt feeders are run to dry-type transformers located at the lighting panelboards and here the voltage is changed to 120/208 volts for the lighting system. Why is not 277/480 volts used for lighting (all code requirements for higher voltages are fulfilled)? In one installation alone there are 24 dry-type transformers costing \$10,000 which could be eliminated (with the exception of one or two required for 120-volt receptacles). Also, fewer panels would be required and smaller wire size could be used with a total possible savings of \$20,000 on one installation alone.

Even though the ballasts for the fixtures may be slightly higher priced for 277-volt operation, it seems to me that it is poor economics to use the lower voltage when the higher voltage is available, from the standpoint of initial investment and also from operating



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- 1.** Aluminum rigid conduit resists corrosion. It resists all kinds of attack, even in contaminated areas. Rarely needs painting, yet it outlasts all others . . . saves for the life of the installation.
- 2.** It's nonsparking—you can safely use Alcoa® Aluminum Conduit in hazardous locations. And it bears the Underwriters' Laboratory approval.
- 3.** It's nonmagnetic. This means less voltage drop. You can run longer lines or use smaller wires. You can separate conductors, regardless of load.
- 4.** It weighs less. You save on installation, handling, storage, transportation.
- 5.** It's good looking. The naturally bright finish of Alcoa Aluminum lasts . . . for there is no coating to peel or blister. You can use this conduit wherever good appearance is important.

Get the full story on Alcoa Aluminum Electrical Rigid Conduit from any Alcoa sales office. Or write Aluminum Company of America, 2327-M Alcoa Bldg., Pittsburgh 19, Pa.



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costs (I'R losses in the conductors). As three large warehouses designed by different engineers have used the lower voltage, it seems to be some other reason than economics that governs the voltage to be used.—F.D.

ANSWER TO C31—The National Electrical Code recognizes voltage to ground not to exceed 300 volts. Recently labor, insurance and local codes have followed suit. There is then no apparent reason for not using the 277/480 system for the application as described, providing that the materials available for use on the system are approved for location and occupancy.

There are opponents of higher lighting voltage who argue on safety grounds, yet 120 volts to ground can be just as deadly as 277 volts to ground when identical conditions exist.

There are also opponents who point to the need for supplementary equipment to supply small 120-volt demands. Your own analysis of the system, which by the way is in line with up-to-date accepted methods, points out the fact that the relatively minor 120-volt requirements are supplied through local 480/120-volt transformers. The cost of this requirement is small when compared to the prime advantages of the higher voltage system which are as follows:

- 1.** 480-volt distribution requires less than half the copper used in the conventional 208-volt systems.
- 2.** This also reduces the conduit sizes.
- 3.** Panels could be eliminated in favor of contactors with pushbuttons.
- 4.** There is no increase in conductor insulation since building wire is rated at 600 volts.
- 5.** Then there is the problem of voltage drop, especially in warehouses where long runs are usually encountered.

All of these facts contribute greatly towards the selection of as high a voltage as is permissible or practicable.

In view of the apparent economies of the 277/480-volt system, I have personally designed and recommended the system for some time. Numerous installations were made in warehouses, manufacturing areas and even office areas. The cost comparisons which were made to justify the 277/480-volt system selection proved the system to be more economical than lower voltage combinations and when comparative bids were received, these facts were substantiated.

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169,000' of TRIANGLE CONDUIT

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The main objections to the use of the higher voltage for lighting were always raised by the clients' maintenance men or the clients' electrical contractor. Once these parties were convinced of the savings, comparable safety, and advantages of the system, the way was clear for acceptance of the system by the owner. It is hard to understand that 12-kv primary distribution was acceptable to your client and that he reneged on the selection of high secondary distribution voltage.—L.K.

ANSWER TO C31 — Generally speaking, you are correct in assuming that it is poor economics to use 120/208-volt, 3-phase, 4-wire for branch circuit lighting when 277/480-volt, 3-phase, 4-wire is available, and allowable by the code. However practical considerations of good lighting design must be taken into account if we wish to uniformly illuminate the large, open floor area of a warehouse, with its high ceilings, using 277-volt fluorescent lighting. At the present time, the Illuminating Engineering Society recommends 5 footcandles of illumination for warehouses. With this relatively low lighting level, it will be very difficult to obtain uniform illumination by using fluorescent lighting, since the required maximum spacing to mounting height ratio will probably be exceeded. Generally, we should not space fluorescent luminaires a distance substantially greater than their mounting height above the floor, to obtain reasonably uniform illumination.

As a proof of the above, we can take the following hypothetical example—using 277-volt, 2 lamp, T-12 40-watt, rapid-start, 4-foot long direct lighting RLM industrial fluorescent luminaires;

Assuming:

- 1) Room Area (100 ft by 100 ft) — 10,000 sq. ft.
- 2) Ceiling Height — 20 ft.
- 3) Mounting Height — 15 ft.
- 4) Footcandle level — 5.
- 5) Room Reflection Factors — 50% ceiling and 50% walls.
- 6) Maximum Spacing Ratio — 1 to 1.

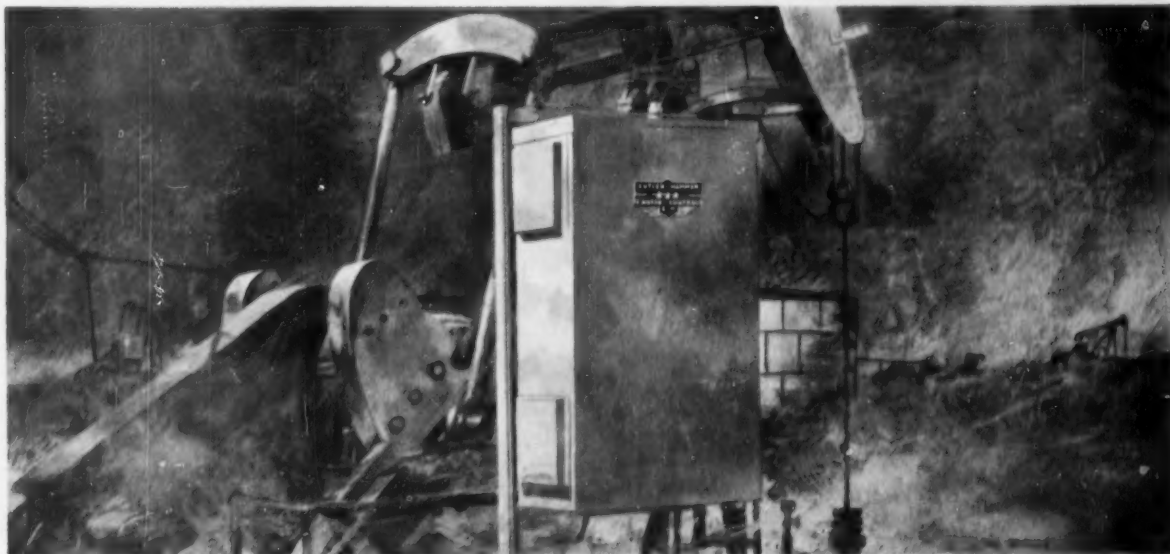
From the above we find:

- 1) Room Index — B.
- 2) Maintenance Factor (M.F.) — 55% (medium, assumed).
- 3) Coefficient of Utilization (c.u.) — 71%.
- 4) Initial Lumens per Luminaire — 5000.

Then:

From the formula based on the "Lumen Method" of Calculation,

New Cutler-Hammer Three-Star Motor Control brings full automation to oil well pumping



If automation means completely automatic operation, oil well pumping has it today. With a remarkable new Cutler-Hammer Three-Star Motor Control unit, oil wells can now be pumped on a pre-set schedule to meet any field allowable . . . completely unattended indefinitely as far as the programming or the electrical equipment is concerned. When a power outage occurs, any number of pumps restart in a fixed sequence to prevent overloading the power lines. The control is protected against lightning and the motors are protected against single-phasing which often results from lightning. Blistering heat, ice, bugs or dust hold no terrors for this control designed to thwart them.

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(1) Total Initial Lumens Required

$$\frac{\text{Footcandles} \times \text{Area}}{\text{M.F.} \times \text{C.U.}}$$

$$= \frac{5 \times 10,000}{.55 \times .71}$$

$$= 128,000 \text{ lumens}$$

(2) number of fixtures required

$$= \frac{\text{Total Initial Lumens}}{\text{Initial Lumens per Luminaire}}$$

$$= \frac{128,000}{5,000}$$

$$= 25 +; \text{ say } 26$$

I leave it to you to try and draw a symmetrical lighting plan layout, maintaining a maximum spacing of 15 ft. between luminaires and no more than one-half this distance from any wall.—L.N.

Can You ANSWER These QUESTIONS?

QUESTION L31—I have heard that low resistance ohmmeters have been found valuable in checking armature windings, especially in direct current series type machines, for high resistance joints or other coil troubles. I wonder if any reader has had experience with this device, and if it can be used as a preventive maintenance tool as well as for shop testing of rewound armatures.—D.H.N.

QUESTION M31—Will painting substation transformers with aluminum paint lower the operating temperature enough to justify the expense of painting?—H.G.R.

QUESTION N31—Can a single phase fractional horsepower motor rated at 1/4 hp, 115 volts be connected by using some external device to operate at some reduced speed in order to obtain a 2-speed motor without considerable overheating? The motor could be a split phase type or a capacitor start.—J. B.K.

QUESTION P31—We have in our plant a 3-phase transformer bank connected delta-delta, 4160-240, 500 kva, approximate impedance 5.1% at rated volts, 75°C. Will someone please explain the meaning of "approximate impedance 5.1%" and how this is used in short circuit calculations?—J. M.

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YOUR ANSWERS BY JANUARY 15**

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This concrete, marble-faced memorial fountain is described as the "crowning jewel" of the Greater Pittsburgh Airport, seen in background. Almost three miles of Spang conduit carry wires to the underwater fixtures that light the pool at night. All of the work on this project was under the direction of the Board of County Commissioners of Allegheny County; John J. Kane, Chairman, Howard B. Stewart, John M. Walker; also the late Harry W. Fowler and George Rankin, Jr.

SPANG HD protects fountain wiring at world's largest airport terminal

... easy bending, corrosion-resistant qualities deciding factors in choice of conduit

County Aviation Director, John B. Sweeney, describes the new \$250,000 memorial fountain as a "crowning jewel" to the Greater Pittsburgh Airport, whose terminal is the largest in the world.

At night the fountain's multi-colored, underwater lights turn the airport's entrance into a display of liquid color.

To make this "jewel" glitter, SPANG HD Galvanized Conduit, ranging from 1/4" to 6", carries all the wiring to the fountain's lighting fixtures. Here's why this was another top-quality SPANG job:

"It took a lot of conduit bending to install the 24 underwater niche lights in

the four cascading pools," says Mr. Andrew A. Joos, foreman for E. C. Ernst, Inc. "SPANG's easy bending qualities were one of the chief reasons we used it throughout the entire job."

SPANG's Heavy-Duty galvanized coating is highly resistant to corrosion and white rust, and is ideal for protection against unusually heavy moisture.

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For a faster installation on your next conduit job, use SPANG HD. See your nearest SPANG Distributor.



A workman is shown making one of the many intricate bends required in installing the fountain's conduit. Because of its exceptional bending and corrosion-resistant qualities, Spang HD was used to carry the necessary wiring.

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Electrical Engineer: Lawrence W. Hornbeck, Pittsburgh, Pa.
Electrical Contractor: E. C. Ernst, Inc., Pittsburgh, Pa.
Spang Distributor: Keps Electric Co., Pittsburgh, Pa.

Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.

GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

Continuity of Grounding Conductor, NM and NMC

Q. Because of the lack of a proper means, and the method employed by some contractors to ground outlet boxes and equipment when using non-metallic cable with a bare grounding wire, I would like to have this matter cleared up so a safe procedure can be adopted.

The manufacturers of steel outlet boxes, junction boxes and cabinets have not provided a grounding terminal in the above named equipment, so the contractors have adopted a method, and some of the wire inspectors have gone along with them, of back wrapping the bonding wire over the cable clamps and bringing pressure on it.

To my mind this is a very hazardous procedure, because with only 3/64 of an inch insulation and a very light outer braid, there is a good chance of rupturing the insulation, and by using the same method the cable will dry out in a short time causing the cable to become loose because of the shrinking of the cable.

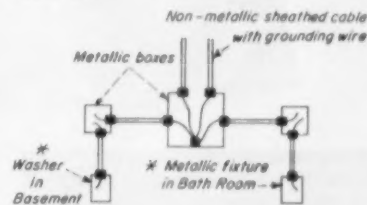
To avoid such conditions it would be far safer to have the bonding wire brought into a box and install a lug on it and secure it under a separate machine screw keeping the bare bonding wire as short as possible, and to the back of the inside of the box.

Would this method of bringing the bonding wire into the box with a lug installed on it and put under a separate machine screw cause a hardship to the contractor? I would like to have your opinion one way or the other to clear this up in my mind.

It takes considerable guts and perseverance nowadays to stand up for a good safe method, as the tendency is to let down the bars and do work in a slack and careless manner.—R.E.L.

A. I sincerely agree with your contention with respect to the method described for ground-

ing metal boxes and other metallic enclosures used with non-metallic sheathed cable. During the past few years I have commented on this subject with a recommendation that the manufacturers provide a U. L. approved grounding terminal in outlet and switch boxes, so that an adequate connection between the grounding conductor and the box may be assured. I personally believe, when such boxes are available, many inspectors from all parts of our country will insist on their use.



Continuity of grounding conductor broken at all boxes. No terminal provided in box for grounding conductors.

* Grounded equipment: continuity of grounding conductor may be very poor due to the many connections involved and the methods used.

As shown by the illustration two factors must be considered. The first concerns the grounding of the box and the second concerns the continuity of the grounding conductor itself. A box with four cables involves four grounding conductors which must be connected to each other and then connected to the box. The method of procedure outlined by you is vulnerable for the reasons you have outlined. Exposed cables in basements may be subject to mechanical injury and it is not unusual to find the cable pulled out of a connector. Exposed cables in cow barns or similar locations may be exposed to damp, corrosive atmospheres and the reliability of a grounding connection such as you describe is questionable. The distinction between a grounded circuit conductor and a grounding conductor is the fact that an open circuit conductor is immediately noted by the absence of light or power. When the grounding conductor circuit is open we have no indication of the condition until

a fault occurs and some one received a shock.

In the absence of any terminal fitting integral with the box, I personally believe that the grounding wires should be connected to a lug, by solder or pressure; and that such a lug should be bolted to the box. Such procedure would be more costly to install but the improved reliability of the grounding conductor would more than justify the expense. I do not believe any reliable contractor who is interested in a safe electrical installation would find such procedure a hardship regardless of the methods used by his competitors, in other territories. I personally do believe that he could help considerably in obtaining the manufacturers' recognition of the problem. He is the purchaser of material and his demands are of concern to the people who design such materials. A concerted effort by both inspector and contractor could do much to rectify the condition that now prevails.—B.A.McD.

Rewiring a Grain Elevator

Q. We plan to do a rewiring job in a grain elevator and would like to use an electrical control room in which we can house the magnetic controllers for the motors used in this elevator. The only possible space available for this control room is approximately 14 ft distant from an exterior wall. If we make this room dust-tight with a self-closing door and ventilate it to the outdoors by means of a duct between the room and the outdoors, would the Code permit the use of ordinary electrical equipment of other than the Class 2, Group G type within such a room?—M.C.

A. If the room is built of dust-tight construction with a self-closing door, it would be possible to use ordinary electrical control equipment within this room of other than the Class 2, Group G

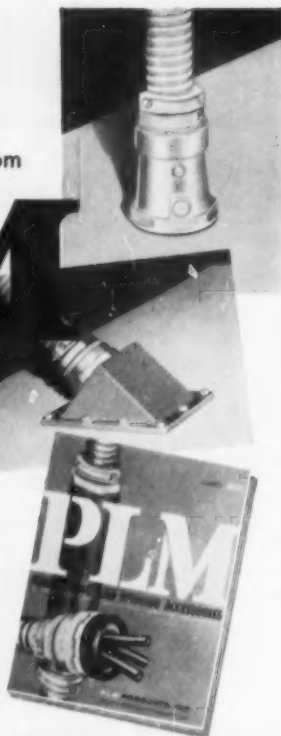
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type provided the duct were constructed of metal not lighter than No. 24 USS gage or of equally substantial noncombustible material. This duct should be screened at the other end to prevent the entrance of small birds or animals and must be protected against mechanical damage or corrosive influences. The Code does not require that it be mechanically ventilated, but it is advisable to place this room under a slight air pressure by having a motor-driven fan blowing air into the room from a source of dust-free air so there will be a slight pressure differential between the room and the work floor outside of this room. By maintaining this slight air pressure on this room, dust will not enter during those times when the door is open for entry or exit from this control area. If the elevator is of combustible construction, matched lumber might be used for the construction of such a control room; otherwise the room should be constructed of noncombustible materials such as metal lath and plaster, hollow tile or concrete block, or structural steel frame with ½-in. or thicker cement asbestos boards.—G.R.

Section 2351: Building Height

Q. Sections 2351-b and 2371-a-4 have reference to multiple occupancy and individual occupancy above the second floor. The question arises as to what would be considered the second floor in a building that has a basement, ground, first and second floor with individual occupancy on all the floors. With respect to the Code, would the basement and ground floors be considered as floors one and two and the other two would be considered as three and four, or what is the Code's intent when it mentions the second floor?—F.D.

A. In the absence of an official interpretation covering this question, I may only express my personal opinion in the matter. A building which consists of a basement, ground, first and second floor is a three-story building. I believe the height of a building is considered from the grade level and all floors at or above grade are to be considered when applying the provisions of Sections 2351 and 2371.—B.A.McD.

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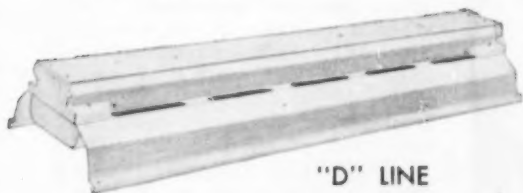
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Raceways Exposed—Different Temperatures

Q. Section 3015 states that raceways shall be sealed when exposed to different temperatures. In rambler type dwellings the conduit from the ceiling boxes is run from the boxes up and over the tops of the ceiling joists. The insulation in the ceiling however is placed in between the joists, and thus the raceway is exposed to both heat and cold when run over the joists. Similarly on the walls, particularly where blanket type insulation is used, the conduit is often times required to be run on the cold side of the insulation and then run to warm side for connection at box. For the average size rambler a large number of seals would be required which would be uneconomical. In this area, with severe winters, the difference in temperatures can reach 100 degrees, and what has been standard practice in installing conduit seems to be a violation of the Code. —F.D.

A. Section 3015 of the Code first appeared in the 1935 edition, and like many other Code rules was recognized in view of the field experience with breweries, meat packing plants and similar types of occupancies which have refrigerated rooms. The rule applies to interior raceways which are exposed to widely different temperatures, and we all know from previous experience that when a raceway is run through areas or rooms where temperatures vary from 100 F to 30 F or lower, which prevail daily, that excessive condensation will result, unless the circulation of air from the warm to a cold area is cut-off. In such types of occupancies we all know from experience the need for such a Code provision and it is my opinion, when this rule was formulated, that such occupancies were primarily considered. While this observation may reflect the intent of the N. E. Code committee at that time, it is quite evident that a literal reading of the text would cover many other applications which have not been so considered in the past.

As an example, a conduit service riser, exposed on the outside of a building may be subject to a temperature of several degrees below zero while the portion inside the building may be in a room temperature of 70 F. This wide variation of temperatures undoubtedly would



Mr. C. J. Cox (at right, above) supervises the installation of Okonite Splicing Tape on 2300 volt motor lead in Seabrook Farms food freezing plant. For 29 years Mr. Cox has standardized on Okonite splicing materials to assure water-tight seals on cables throughout the plant. Note moisture conditions indicated by frozen condensation on pump head.

Okonite Tapes resist moisture, freezing... keep world's largest food freezing plant operating

For 29 years, Mr. C. J. Cox, supervisor of all construction and engineering for Seabrook Farms Co., has depended on Okonite Tapes to maintain the vast electrical network that keeps the world's largest food freezing plant operating. All electrical circuits (totaling 20,000 h.p. connected load), lights, as well as power for the motors and pumps which provide continuous freezing and storage capacity, are spliced and terminated with waterproof Okonite Tapes to assure positive protection against the moisture always present in the plant.

In every phase of Seabrook's operation, moisture is a problem. Treatment of food, freezing, processing, storing... all are damp operations with continuous condensation

on cables and equipment alike. Low temperatures of the freezing and holding rooms make splicing difficult.

Okonite Tapes offer effective waterproof splices that are not affected by dampness or low temperatures. Both Okonite Rubber Tape and Okonite High Voltage Tape fuse into a solid self-vulcanizing wall of tough, waterproof insulation. Protected by Manson Friction Tape, splices maintain their moisture resistance through many years of exposure to condensation and freezing temperatures.

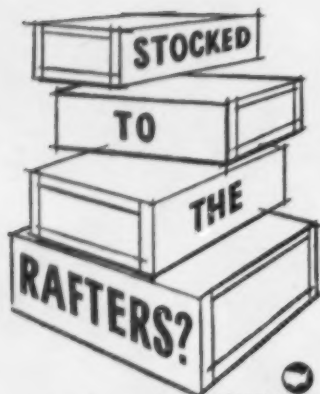
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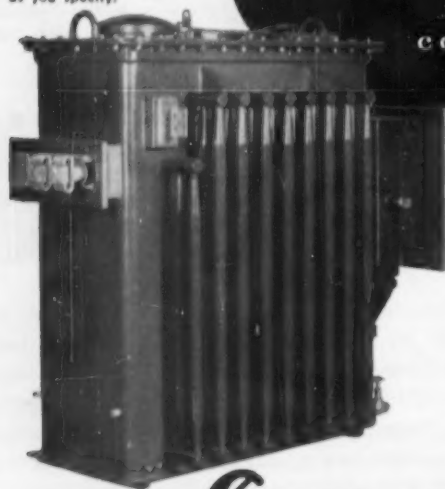
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REPRESENTATIVES IN PRINCIPAL CITIES

warrant the installation of a seal where the conduit enters the building. To my knowledge however this has not been required by inspection authorities, possibly on the basis that it is not generally considered that the intent of Section 3015 covered such an application. Thousands of such service applications have been in use for many years and I doubt that field experience indicates the need for the application of this Code rule.

In the case of the insulated house which you have presented, the variations in temperatures between the cold and the warm side of the insulation could be influenced by other features of the building design and I doubt that the 100 degree variation would exist for any appreciable length of time. Thousands of such installations have been made for many years and it appears to me that field experience does not indicate the need for enforcing the provisions of Section 3015. There are many variables involved which must be fully appraised before such action would be warranted. While a literal reading of the text may indicate that there is a Code violation, I doubt that there is any violation with respect to the original Code intent—B.A.McD.

Open Bus Installation

Q. We are bringing service into a plant at 13.8 kv and plan to use open bus immediately inside the building at the point where the service enters the building. If there are no barriers between the buses used for the different phases, how much clearance through air must we provide? These buses will lead to transformers filled with uncombustible dielectric fluid and the entire area containing the bus bar, transformers and service switch gear will be enclosed within a woven wire fenced area.—D.B.

A. The National Electrical Code under Section 7122 will provide a minimum air separation between bare live parts of 7 in. and 5½ in. between any bare live parts and adjacent surfaces over which or by which these bare buses pass. You will also notice in the fine print note following this section that wherever space limitations permit, these distances should be increased.—G.R.



The use of Corning Pattern No. 70 Lens Panels creates comfortable glare-free light on work surfaces in this modern office.

Use this lens panel to get more profitable lighting contracts

You use Corning Pattern No. 70 to deliver maximum light in the useful zone with low brightness in the glare zone.

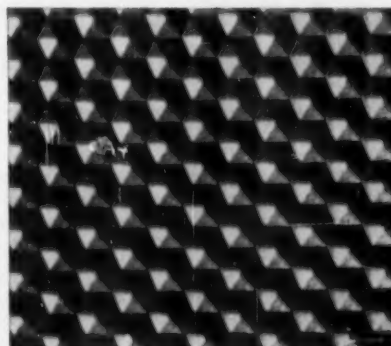
Use it to get better lighting installations in stores, banks, offices—wherever you want low brightness, glare-free light.

A pattern of hexagonal prisms on one surface controls the light. These prisms bend light rays downward creating more useful illumination. Light in the near horizontal angles is reduced so that surface brightness of the panel is low at normal viewing angles.

Result is a distribution of emitted light in a pattern of even illumination on the working surface.

Lightweight—and you can get panels up to 100 inches long—for one-piece fixtures that eliminate dust- and light-leaking seams. Water-white crystal, dimensionally stable glass. Won't warp, fade, discolor, or show age. Has no dust-attracting static charge. Cleans easily.

For free information about this interesting and useful lightingware, please use the coupon.



Close-up view of Pattern No. 70, a prismatic crystal lens panel. You can get Pattern No. 70 in widths up to 34 inches, lengths up to 100 inches.



CORNING GLASS WORKS
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Corning means research in Glass

CORNING GLASS WORKS, 65-12 Crystal Street, Corning, New York

Please send me Bulletin LS-47A: "New Corning Pattern No. 70 Low-Brightness Lens Panel."

Name..... Title.....

Firm.....

Address.....

City..... Zone..... State.....



Now you can operate two H-1 400-watt outdoor mercury vapor lamps from a single Sola Constant Wattage Ballast

Operating advantages embodied in the Sola Constant Wattage Mercury Vapor Lamp Transformer have proved so desirable and practical that this type of ballast is fast becoming the generally-accepted standard for mercury vapor lighting installations. Now constant wattage operation plus the economy of two-lamp ballasting is available in a single Sola CW Mercury Vapor Lamp Transformer.

This new design is specifically for two-lamp, outdoor service in commercial and industrial applications of H-1 400-watt mercury vapor lamps. Its famous Constant Wattage Principle of operation offers users the follow-

ing performance features:

- Low starting current surge
- Regulated lamp wattage and light output
- Open circuit protection
- Elimination of need for primary taps
- No extinguishing on line voltage dips
- Extended lamp life

For additional information on your particular application, contact your sales engineer listed below. He's one of a nationwide organization maintained by Sola Electric Co. to provide you with prompt service.

SOLA *Mercury Vapor Lamp* TRANSFORMERS

Write for Bulletin 17L-MV-244

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In The News

Long-range Planning Urged, Interdependence Emphasized at NEMA Convention

At the annual meeting of the National Electrical Manufacturers Assn. in Atlantic City, November 12-15, Ralph J. Cordiner, president of the General Electric Co. said that this nation's output of electrical products would total about \$20 billion this year—more than double that of ten years ago. "Even if we continue to serve our customers only as well as we have in the past decade, we can see that by 1976, the market for electrical products reported by NEMA should be in the order of \$90 billion at today's prices," he said.

Mr. Cordiner said that "the number of establishments in the electrical machinery and equipment industry increased 46% between 1947 and 1954" and that "the number of firms in electrical manufacturing had risen from 4,400 firms in 1945 to 5,600 in 1953, according to Department of Commerce reports."

Discussing long-range planning, Mr. Cordiner warned of the necessity for the electrical industry "to make today's decisions in the perspective of what we expect conditions to be ten or twenty years from now."

"If we do not," he added, "we may fail to make the commitments in research, product development, facility and capital planning, and market and manpower development—commitments that must be made now, in order to measure up to our future opportunities and our responsibilities to the American people."

Mr. Cordiner said that, since 1939, labor rates have been increased by 178% and raw materials by 163%, while the prices of electrical machinery had advanced only 100%, and the prices of home electrical appliances only 41%.

"We can be proud of the increase in volume and efficiency that have helped the industry absorb some of these increased costs, because they represent real progress for our customers and employees," he said. "But no industry can absorb so much cost increase in so few years, and still finance essential growth and compensate its investors adequately."

Interdependence Revived

Interdependence, a term originally proposed in 1944 to bring to all companies and organizations in the electrical field the concept that each is mutually dependent on the other for success in a great and growing industry, was given new life and energy as NEMA swung its weight and prestige behind a revitalization of the 12-year-old, one-for-all and all-for-one theme.

The move was a key feature of the Association's program. It followed the presentation of "Spirit of Interdependence '56", a professionally cast and staged revue highlighting top sales promotional programs now in progress by all segments of the industry. Heading the first-time offering of this magnitude was the originator of the interdependence concept, N. J. MacDonald, Elizabeth, N. J., president, The Thomas & Betts Company.

Backing up the revitalization theme with comprehensive, illustrated messages covering industry-wide, business-getting programs were the following four electrical manufacturing company executives: R. J. Sargent, Pittsburgh, Pa.; C. W. Higbee, New York City, manager, Electrical Wire and Cable De-

partment, United States Rubber Company; Hoyt P. Steele, Des Plaines, Ill., president, Benjamin Electric Manufacturing Co., and A. Callaway Allen, St. Louis, Mo., sales manager, Electrical Division, Wagner Electric Corp.

Commercial Wiring Program

Results of a market survey conducted this year has helped lay the groundwork for a commercial and institutional adequate wiring program which the National Adequate Wiring Bureau will launch in 1957, was announced by Andrew Doremus, manager-advertising, Construction Materials Division, General Electric Co., and chairman of the Bureau's Plan Committee.

The Bureau is preparing a program that will seek to enlist the support of all branches of the electrical industry and will furnish promotional materials necessary to help electrical utilities and contractors sell better wiring installations in business establishments and public buildings.

The first step will be a plan book which will announce and explain the commercial wiring program and outline a course of action to help local bureaus, leagues and utilities to promote better wiring to the individuals influencing the wiring of commercial occupancies.

Secondly, a consolidated listing of



JOHN W. HAGER, president-elect for 1956-57, IAEI Eastern Section, is flanked by a dozen of his co-officers at the final session of the section's annual meeting. With him, in the first row, are IAEI president L. O. Trim, Burbank, Cal.; J. D. O'Connell, New York City, executive committeeman; John W. King, Providence, R. I., secretary; Hager; 1st, 2nd and 3rd vice presidents E. B. Fetty, Washington, D. C.; Clifton Clark, Windsor, Conn., and H. L. Schaefer, Closter, N. J. Backing them up are B. F. Greene, New York City; M. C. O'Rourke, Waterbury, Conn., and G. H. Sharden, Elizabeth, N. J., executive committeemen; Frank Stetka, Washington, D. C., Executive Council; B. A. McDonald, Rochester, N. Y., executive committeeman, and G. J. Bostley, Rensselaer, N. Y., 4th vice president.

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DOES SO MANY
JOBS SO WELL**

Interlocking
channels...
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Re-inforced ten-
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No. 420

Help yourself to a Chan-
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iest plier of them all. It grips
like a pipe wrench... is easy
to use in hard-to-get-at
places. And Channellock has
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no other plier: Interlocking
channels that can't slip or
"jump out" and the rein-
forced tension edge that
withstands maximum grip-
ping force. These exclusive
features are the reasons why
Channellock is the first choice
of mechanics everywhere. So
ask for Channellock... and
be sure you get *genuine*
Channellock. Look for the
trade mark on the handle.

CHANNELLOCK
first choice of skilled Mechanics



CHAMPION DEARMENT TOOL COMPANY
MEADVILLE, PENNSYLVANIA



INVITATION to Atlanta, Ga. for the 1957 IES National Technical Conference (September 9-13, 1957) was extended to delegates at the 1956 Conference in Boston by: Walter C. Fink, Jr., Senior Fluorescent, Inc., and Regional V-P of NALMCO; Joe B. Browder, Sales Manager, Georgia Power Co., and Treasurer of IES; Johnnie E. Sweatte, Manager Lighting Division, Georgia Power Co.; and J. Dixon Mitchell, Westinghouse Electric Corp., and IES Southern Region Vice President; all of Atlanta.

promotional materials of a non-commercial flavor, available from various sources and suitable for use in a program aimed at commercial occupancies, will be developed and circulated to the field.

Thirdly, publicity will cover advisory service to the press, including stimulation of feature editorial coverage where appropriate, special artwork, photographs and purchase of reprints.

Then, rating sheets, somewhat analogous to the Housepower rating sheets recently introduced in the residential field, will be released. Initially, occupancies covered will be largely those most strongly urged for immediate attention by survey respondents. As companion pieces to these rating sheets, direct mail folders will be prepared to permit the contractor or utility salesman to use both promotional materials in pairs as sales tools when he visits prospective customers.

McGraw Award

Arthur A. Berard, president, Ward Leonard Electric Co., Mt. Vernon, N. Y., and V. Robins Tate, executive vice president, Perfex Corporation, Milwaukee, Wis., received the James H. McGraw Award, Electrical Manufacturers medal and purse at the NEMA meeting.

Mr. Berard was cited for his personal leadership, encouragement and guidance in the constructive and cooperative activities of the electrical manufacturing industry, and Mr. Tate for his personal leadership and initiative in the development of

basic standards for the automatic control manufacturing industry.

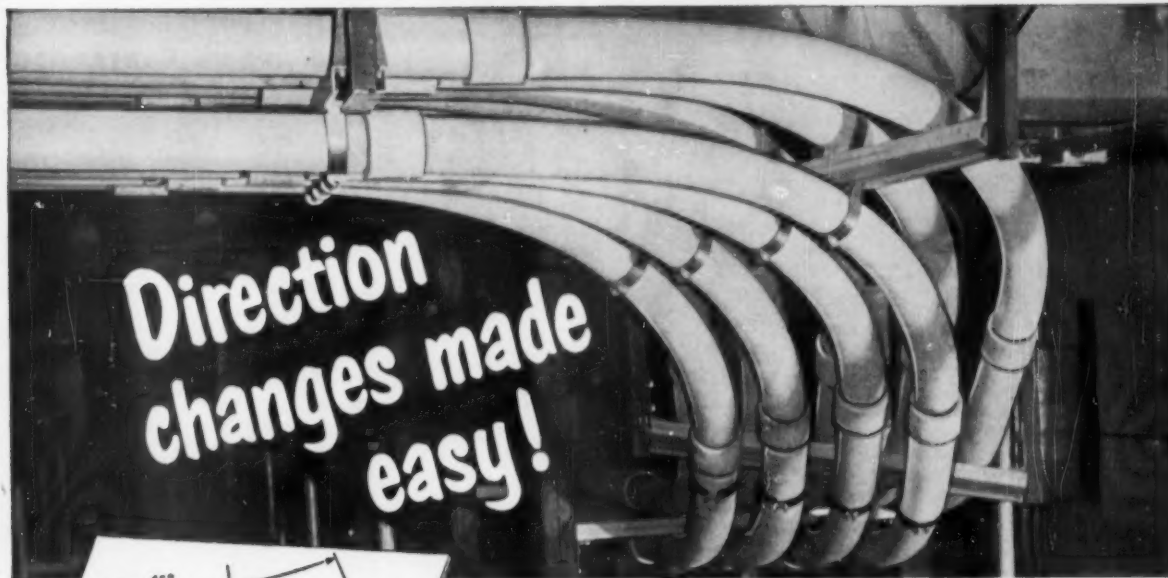
The judges who selected and nominated the medalists for this industry honor were: W. S. Edsall, Chase-Shawmut Co.; H. G. Blakelee, Cory Corp.; R. M. Casper, Allis-Chalmers Co.; R. L. White, Landers Frary & Clark; and W. T. Stuart, *Electrical Construction and Maintenance*.

Officers Elected

A. A. Berard, president of Ward Leonard Electric Co., Mt. Vernon, N. Y., was elected president of NEMA at the concluding session of the convention. Mr. Berard succeeds J. W. Corey of Cleveland, Ohio, president of the Reliance Electric & Engineering Co. F. F. Loock, Milwaukee, Wis., president, Allen-Bradley Co., was named treasurer. Vice presidents chosen were N. J. MacDonald, Elizabeth, N. J.; J. J. Mulen, Jr., St. Louis, Mo.; B. C. Neece, New Britain, Conn.; W. V. O'Brien, New York, N. Y.; and J. L. Singleton, Milwaukee, Wis.

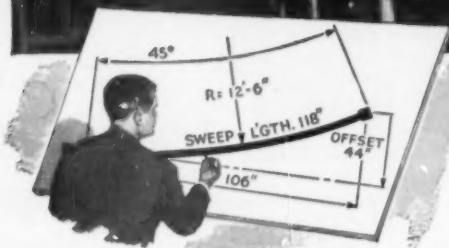
50-Year Certificates Awarded

A. B. Bussmann, vice president of Bussmann Mfg. Company Division, McGraw Electric Co., St. Louis; Louis W. Cole, chairman of the Board of Federal Pacific Electric Co., Long Island City, N. Y.; and D. H. Osborne, vice president of the Porcelain Insulator Corp., Lima, N. Y., were presented the association's 50-year award for a half a century of service to the electrical industry.

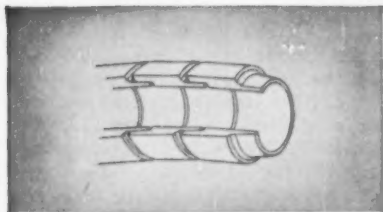


Direction
changes made
easy!

(Photograph courtesy of ELECTRICAL WEST.)



...with standard fittings for TRANSITE^{asbestos-} DUCTS^{cement}



5° bend segment sketched in detail. It consists of a straight section of Transitite stock with a male taper on one end and a female taper on the other... each machined at an angle of $2\frac{1}{2}^\circ$ to the center axis. Segments can thus be used single, or combined to form bend sections whose curvature is any multiple of 5° .



Photograph showing use of bend segments and curved segments with Transitite Ducts.

When you use Transitite Ducts, you have available a wide variety of standard fittings, made of the same asbestos-cement material as the ducts themselves. These fittings save time and expense because they provide maximum flexibility in laying out or constructing a duct system. They facilitate clearing unexpected obstructions or accommodating revisions in the original layout.

For instance, the new Transitite 5° Bend Segments (shown at left) can be used alone to form simple and complex curvatures of any multiple of 5° . Used with other standard Transitite curved fittings, they form curvatures of odd degrees. Thus, they enable you to simplify cross-overs

and transformations... to clear obstructions... to form unusual or special bend or offset sections. They eliminate the need for purchasing special radii bends or sweeps. The other standard Transitite fittings that facilitate directional changes are the offset bends, standard 45° and 90° bends, sweeps, curved segments, laterals, tees, elbows and deflection couplings.

For complete information write for new brochure EL-45-A, "Fittings and Dimensions of Transitite Ducts." Contains all dimensional data required by the designer. Also available, "Transitite Duct Underground Installation Sheet," EL-43-A. Johns-Manville, Box 14, New York 16, N. Y. In Canada, 199 Bay St., Toronto, Ontario.

5 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

- 1. Corrosion-Resistant.** Transitite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.
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- 3. Incombustible.** Transitite will not burn or contribute to formation of

smoke, gases, fumes. It confines burn-outs, will not soften under heat.

- 4. Higher Thermal Conductivity.** Cables run cooler in Transitite, reducing I²R losses, increasing current capacity and prolonging insulation life.
- 5. Easy to Install.** Transitite Ducts are light weight, easy to handle. Joints are quickly made. Long 10-foot lengths reduce number of joints in line.



Johns-Manville TRANSITE[®] DUCTS

TRANSITE KORDUCT—for
installation in concrete

TRANSITE CONDUIT—for exposed work and installation
underground without a concrete encasement

tomorrow's standards... today!



The Ohio Turnpike is the newest link in a national chain of superhighways that will eventually tie East to West. The most modern concepts of traffic engineering are reflected in the construction of this magnificent road. What transformers are used for service and lighting? Marcus, of course!

Electrical contractors:
Amon Electric Co., Warren, Ohio
Peterson-Webster Electric Co.,
Youngstown, Ohio



Marcus TRANSFORMER CO., Inc.
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"Mark of Quality"

Representatives in Principal Cities

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

SERVICE CONTRACTORS

*Here's the fuse that can
make your job easier*

- **NO UNNECESSARY BLOWS DURING SAFE OVERLOADS**—exclusive Pierce screen vent design permits gases and heat to escape freely. Only shorts and dangerous overloads can cause a blow. This saves you unnecessary troubles, and cuts down on costly plant downtime.
- **EASY LINK REPLACEMENT**, requiring only a screwdriver and a few seconds' work. Screws holding link have nuts locked in position. Sturdy tubular bridge assures perfect link contact and knife alignment. You don't need a lot of parts—just the replacement link.
- **LOWER FUSE COSTS**. Because your fuse body doesn't become charred by frequent blows, excessive heat and afterblows, Pierce Fuses last 6 to 8 times longer. It's worth investigating!

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PIERCE RENEWABLE FUSES, INC., Leicester, N. Y.

I would like to see and compare one of your Balanced Lag Pierce Fuses:

() Knife Blade Type () Ferrule Type

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Company.....

Address.....

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Florida Contractors Hold Annual Convention

The Florida Association of Electrical Contractors (FAEC) held its fourth annual convention and electrical trade show October 24-27, 1956, at Bal Harbour, Miami Beach, Fla., in the Balmoral Hotel. Nearly 500 were registered for this 4-day event.

First day's business session was opened with an address by FAEC President Howard L. Palmer in which he reviewed briefly the work and growth of the Association during the past year.

A talk on accounting practices and procedures, titled "It's Your Money" and specifically developed with the needs and problems of electrical contractors in mind, was presented by Dr. J. Everett Royer, professor of accounting, and assistant dean of the School of Business Administration, University of Miami.

A timely panel discussion titled "Who Carries Who", was moderated by Harry Krebs, district financial manager, Graybar Electric Co., Tampa. Panelists were G. J. Brown, credit manager, General Electric Supply Co., Jacksonville, and H. A. Patrill, secretary-treasurer, Hughes Supply Co., Orlando, Fla.

Mr. Krebs reviewed the industrial growth going on and planned in the State of Florida, and discussed the impact this growth will have on credit and financing.

Mr. Brown advised the electrical contractors to use a good system of cost accounting and to know at all times their financial condition. He suggested they bring financial statements along when they go to electrical distributors for credit.

Mr. Patrill discussed what electrical contractors should expect of a bank, and pointed out that banks serve three functions: keeping, lending and saving of money.

Wes Olson, president of Olson Electric & Hardware Co., Daytona Beach, gave some practical answers to the question tagged as title of his talk, "Is 'Materials-On-Site' Hurting You?". Any job that drags costs money, he said, pointing out that working capital gets tied up due to methods of payment. "Watch specifications that contain high percentage holdbacks" he advised, and cited practices being followed on State school jobs which are unfair to electrical contractors.

Walter E. Engle, president of Engle Electric Co., Lakeland, discussed some important pending



WHAT?

AB-I's cost less than safety switches?

YES!

In many cases Westinghouse AB-I circuit breakers do. And check the other concrete benefits that safety switches can't match.

You realize definite reductions in wiring costs: because the enclosure is installed first and unit breaker wired later, there is no obstruction to pulling wires. At the present-day electrician's rate of pay, this adds up to real dollar savings.

In order not to tie up your capital until breakers are actually needed on a job, you may purchase the enclosure only. Westinghouse unit breakers are sold separately for your convenience.

Don't these reasons prove to you that Westinghouse AB-I breakers are today's best circuit protection buy?

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WATCH WESTINGHOUSE!

WHERE BIG THINGS ARE HAPPENING FOR YOU!

Latrobe Electrical Products

Tops in Design

"Latrobe" Floor Boxes and Wiring Specialties are designed to do their job easily and surely with no excess parts. This same compactness of design makes for fast, easy installation.



ADJUSTABLE FLOOR BOXES

Adjustable Floor Boxes are now bonded which makes them fire-proof—come in single round or square bodies—also furnished in square single gang, two gang, three gang and four gang types.



"LATROBE" PIPE OR CONDUIT CLAMP

This new clamp is made of highest quality malleable iron, with a double safety bite of case hardened tool steel and is cadmium plated to prevent rust. Two models—one for Right Angle and the other for Parallel support. Each model comes in 10 sizes to handle pipe or conduit 1/2" thru 4".

Latrobe Products

- Non-adjustable Floor Boxes
- Adjustable Floor Boxes
- Gang Boxes . . . Cover Plates
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- Pipe or Conduit Hangers
- Insulator Supports
- Cable Supports . . . Fish Wire
- Staple and Cable Clips

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Salco Representatives in all principal cities.



ELECTRICAL ESTIMATING PANEL consisted of six electrical contractors (l to r): John Myers, Miami; Al Ralston, St. Petersburg; James Dandelake, Jacksonville (moderator); Howard L. Palmer, Orlando; Dick Ogden, Fort Myers; and Dick Quinby, Tampa.

legislation before the State Legislature, in his talk on "New Laws Will Affect You".

An open minded and down to earth forum of current electrical contracting problems was held, with a 6-man panel of electrical contractors discussing any and all questions presented by members of the audience. FAEC President Howard Palmer served as moderator, and those on the panel were: Vince Burkhardt, Jim Dandelake, Jim Lowry, Axel Ornberg, Norwood Hope, and Jim Ward. Subjects introduced included: operating at a profit, wholesalers extending credit to poor credit risks (contractors who continue to take jobs without a profit and without adequate capital invested), need for more apprentices, how to select and train an estimator.

"Planning for Profits" was the title of a talk given by D. B. Clark, Florida district manager for Lamp Division of General Electric Company, Tampa.

A highlight of the conference was the moderated panel discussion on electrical estimating, which included both panel member presentations and audience questions on estimating for profit in several important electrical contracting fields. Moderator for this session was Jim Dandelake, president of Miller Electric Co. of Florida, Jacksonville, assisted by Howard L. Palmer, FAEC President.

Estimating residential wiring was presented by Dick Quinby, Quinby Electric Co., Tampa.

"The Estimators Tools" was the subject of the presentation made by Jim Dandelake, in which he discussed the day-to-day tools used by the estimator (scale, tally meter, calculating and adding machines, lighting, supply of all types of pencils, electric pencil sharpener, complete file of electrical catalogs,

etc.), and the need for having good tools and keeping them in the best working conditions possible.

"Estimating the Ten Dollar Job" was presented by Howard L. Palmer, who told the contractors that they "should not" estimate such jobs. However, he outlined some of the things that should be done in lieu of making an estimate, such as giving the customer an "idea" of the cost, and to add estimating time when a customer demands a firm estimate. In such cases, these small jobs should be figured on the same basis as \$1000 or higher jobs, he said.

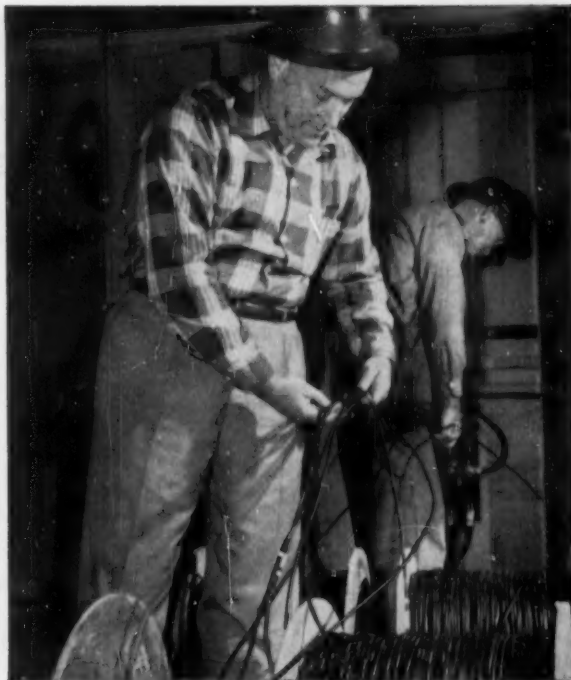
Other subjects covered included estimating of heavy construction, light commercial construction, and charges to be made for "service calls".

Another moderated panel discussion was the "Contractor-Jobber-Manufacturer Forum", repeated again this year by popular request following presentation of a similar panel at the past two annual conventions. Moderator was J. Arthur Turner, Central Armature Works, Tampa. Panelists were: Manufacturers—D. H. Nickell, Square D Co., Tampa, and Walter J. Barnes, National Electrical Products Inc., Atlanta; Distributors—Gordon C. Cutler, Hughes Supply Co., Orlando, and Day Harper, Graybar Electric Co., Tampa; Contractors—Vince Burkhardt, Arrow Electric Co., West Palm Beach, and Axel Ornberg, Curry Electric Co., Orlando.

Officers were elected for the coming year, as follows: President—James Dandelake, Miller Electric Co. of Florida, Jacksonville; 1st Vice President—R. H. Palmer, Jr., Palmer Electric Co., Lake Worth; 2nd Vice President—J. Arthur Turner, Central Armature Works, Inc., Tampa; and Secretary-Treasurer—Hillary B. Garvin, Orlando.



Neoprene-jacketed feeder cable is readied for sweating lug before cutting into 460-volt switchboard. Neoprene jacketing stays flexible, easy to handle . . . resists ozone, electrolytic attack, oil and grease.



#14 neoprene-jacketed wire gets a close inspection as it is pulled from switchboard to ventilation-fan control board. Neoprene's resistance to aging assures long-term protection for wire.

Over a million feet of neoprene-jacketed cable to be used in third tube of Lincoln Tunnel



The Port of New York Authority. Nearly completed third Lincoln Tunnel tube (far right) will improve traffic flow. Neoprene-jacketed wire and cable play vital roles in tube's lighting, signal and ventilation systems.

A vast complex of neoprene-jacketed wire and cable will be installed in the Lincoln Tunnel's new third tube—now nearing completion under the Hudson River between Weehawken, N. J., and Manhattan. Over a mile in length, the tunnel will require 2000 V lines for tunnel lighting, 600 V lines for traffic signals and supervisory control, plus additional miles of conductors for 5-7000 V high-tension power distribution.

In all, The Port of New York Authority estimates 1,017,000 feet of neoprene-jacketed wire and cable will be used . . . from the vital ventilation system where 24 powerful fans change tunnel air every 1½ minutes, to the hundreds of lights that illuminate the tunnel. Neoprene jacketing was specified because it assures long-term protection for conductors wherever they're installed.

Like the Port Authority, you'll find neoprene's resistance to flame, ozone, oil, grease and corrosive atmospheres important for safety and service. So why not let neoprene, Du Pont's synthetic rubber, cut replacement and maintenance costs on your tough jobs? Neoprene-jacketed wire and cable are available in voltage ratings to meet your requirements.

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FREE! THE NEOPRENE NOTEBOOK. Every issue contains interesting stories about products made with neoprene. Actual case histories give you the facts about neoprene's longer service life. Clip coupon to get on the mailing list.

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The rubber made by Du Pont since 1932



BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

TORK

time switches



Precision timing FROM 40 BELOW ZERO

35 Ampere INCANDESCENT LAMP LOAD RATING

Astronomic timing AT A PRICE YOU CAN AFFORD

WRITE NOW ** FOR
COMPLETE DETAILS

TORK
MOUNT VERNON, NEW YORK

*Carry WATER, GAS
AIR LINES, CABLE
at any angle to beams*

with

"EFFICIENCY"

CONDUIT
HANGER
"TYPE F"

On open steel construction. Efficiency "Type F" conduit Hangers are your best choice for carrying 1/2" to 2 1/2" pipe and armored cable. Patented radiating ridges and 5-point gripping surface keep pipe and cables suspended dead center, permitting it to be carried securely at any angle to the beam.

Write today for Catalog 38-A.



"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

Efficiency

ELECTRIC AND MANUFACTURING CO.
EAST PALESTINE, OHIO



MANUFACTURERS OF EFFICIENCY
ELECTRICAL DEVICES FOR CONDUIT
AND WIRE CABLE SUSPENSION

Workshops for NYC Contractors

Consolidated Edison Co. has announced a series of one-day Modernization Workshops designed to acquaint New York City contractors with the technical and business aspects of rewiring work. Speaking before an audience of several hundred members of the electrical, building and financial industries, Con Edison's Adequate Wiring Bureau manager, Joseph Covington described the program as a concerted effort to enable contractors to accomplish the billion-dollar rewiring market potential in the New York area.

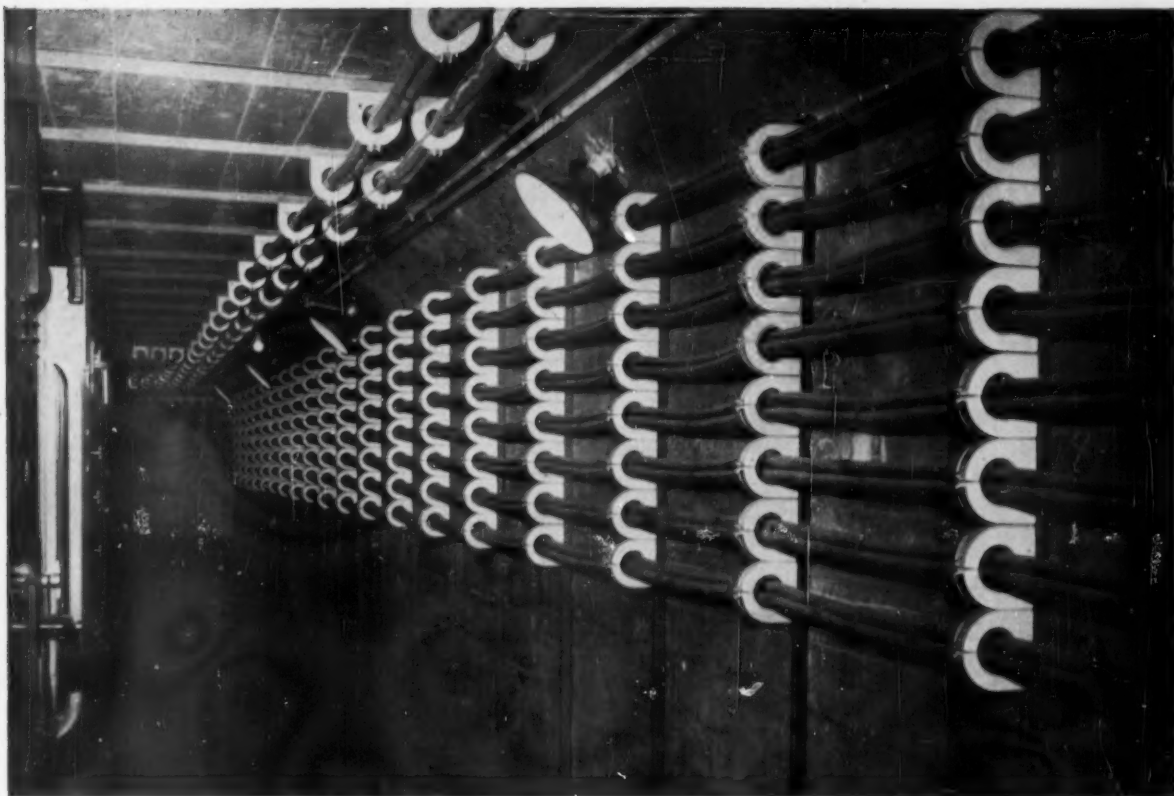
There will be two types of sessions, Covington explained, one for small residential structures to 6-family occupancy and the other for larger buildings. Each will consist of a 10-point program covering rewiring methods, sales and promotion techniques, financing procedures, and an open discussion of problems encountered by contractors. Meetings will be addressed by a landlord and representatives of the FHA and a local bank. Covington reported that a sample study of contractor interest showed an overwhelmingly favorable response to the workshop project.

Significant trends in rewiring activity were brought out in a discussion of Progress in Adequate Wiring by assistant vice president C. W. Meytrott of Con Edison.

1956 Edition of NE Code Available

The new edition of the National Electrical Code has been published by the National Fire Protection Association. Copies of the Code will be available after Christmas from regional offices of the National Board of Fire Underwriters located at: 85 John St., New York 38, N. Y.; 222 W. Adams St., Chicago 6, Ill.; and 465 California St., San Francisco 4, Calif. Price: \$1.00 each.

Deluxe editions of the Code featuring larger type are also available from offices of the NBFU. Compson Code Company, P. O. Box 357, Lansing 2, Mich, publishes a stiff-covered edition with larger type and a plastic spiral bind that permits the book to lie flat when opened to any page. Single copies cost \$2.75, with owner's name stamped on cover in gold or silver the charge is \$3.00 for single copies.



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world's most modern shell plant specifies
KEYSTONE 5KV CABLES

Nothing was spared to provide the surest and most adequate supply of electrical energy for the huge motors, pumps and other equipment that make the Scranton Ordnance Plant, operated by the United States Hoffman Machinery Corporation, the largest and most modern of its type in the world.

In production less than 18 months after the project was approved, the plant makes extensive use of Keystone insulated 5kv non-shielded cable.

A typical application of this top-quality, yet economical cable is found in the plant's forge

shop. There, 1/conductor 750,000 cm Keystone insulated 5kv non-shielded cables feed power from 3-5000 kva transformers to 12-600 hp and 12 - 450 hp pumps which provide hydraulic pressure for the main drawing and forging operations. These dependable power feeder cables are installed in interconnecting underfloor tunnels like the one shown above.

You, too, can use Keystone cables to advantage in your operation. Ask for Bulletin EC-463 for full details or write The Okonite Company, Passaic, N. J.

2954-A

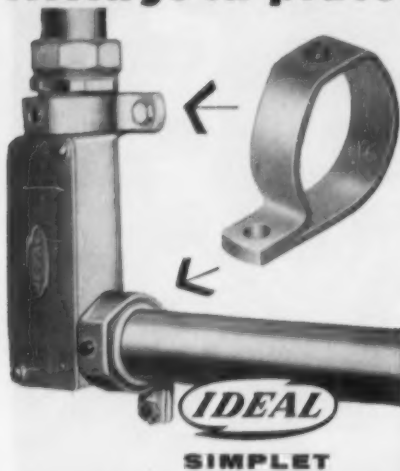
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fast way to hold fittings in place



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- SAVE TIME
- SAVE MONEY

Made *only* to fit all sizes of Ideal-Simplet Rectangular Fittings, these Hub-Lugs (patent applied for) provide low-cost mounting of fittings in lighting or wiring systems for industrial and commercial building. Use in place of more expensive welded-on lugs.

Perfect for machinery when applying conduit fittings to electrical control or operating systems. It's the only *safe* application method that provides a moisture-proof, strong, rigid, durable mounting of fittings! For more details . . .

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NISA News

NISA's Board of Directors met at the Hotel Roosevelt in Pittsburgh on November 3, 4 and 5 for its mid-year meeting. The directors meet annually prior to the national convention and again at mid-year, usually in a city where a major motor manufacturer or manufacturers are located, for purposes of building trade relations. This year the group met with officials of Westinghouse and toured the corporation's East Pittsburgh Works. The directors were guests of Westinghouse at a dinner Sunday evening, November 4 at the Pittsburgh Athletic Club and for lunch the next day at East Pittsburgh.

In a recent survey of NISA members it was learned that more than 30 shops have recently completed new buildings or are in the process of constructing new shops. Many others are modernizing.

Joseph M. Harrington, formerly secretary-manager of the Iowa Chapter of NECA, reported as assistant to executive secretary Fred B. Wiperman on November 19. Harrington, 33, is a graduate of Iowa State and George Washington Universities, has a background in trade association law and management.

NISA vice-president Alfred Elson Jr. of New England Machine & Electric Co., Pawtucket, R. I. was honored recently with the Boys' Club Medallion, presented to him by Boys' Clubs of America for his work in behalf of the Pawtucket Boys' Club of which he has served as vice-president and as a member of the board of trustees.

A NISA Associate Member, The Helwig Co. of Milwaukee, Wis., has announced plans for a new building adjacent to the present plant. Included will be a new "rush order" department. The addition is expected to be completed by 1957.

Harold Montgomery has purchased full interest in Industrial Electric Supply, Inc., Rapid City, S. D.

A Christmas party at Botsford Inn in Farmington, Mich., is planned by Great Lakes Chapter. The group toured the General Electric service shop in Detroit October 26.

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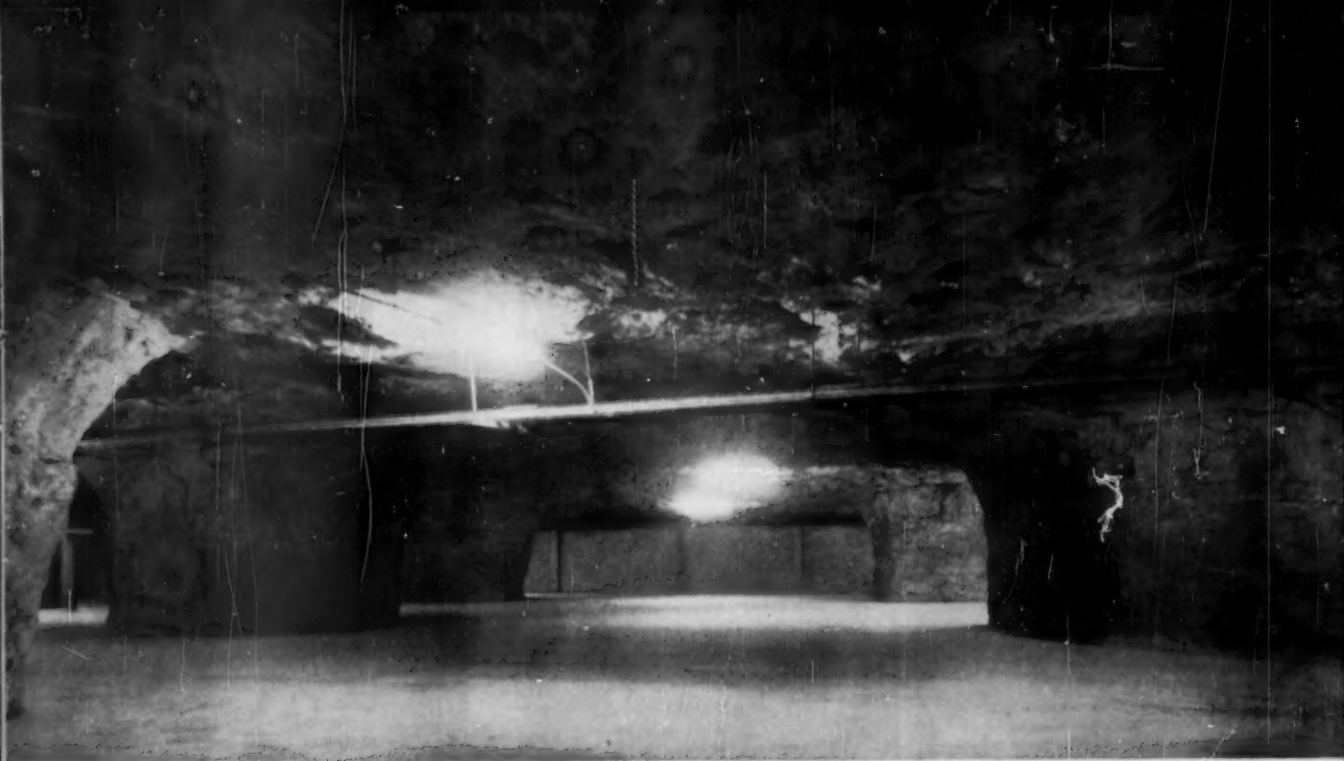
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IN THIS UNDERGROUND FREEZER in an old stone quarry in Kansas City, Kansas, sections of G-E White conduit are subjected to a constant coating

of ice. Because the conduit leads up to the surface through 70 feet of rock, it must withstand attack by moisture condensation and severe soil conditions.

EVEN IN UNDERGROUND FREEZER G-E White resists corrosion

Whether installed in the new Inland Cold Storage Company, Inc., giant underground freezer at minus 5 F, or tested in 100% humidity at 104 F temperature—G-E White rigid steel conduit proves that its corrosion resistance is unsurpassed.

Before this entirely new conduit was introduced commercially, it was tested for resistance to nearly every type of corrosive condition. It was immersed in sulphuric acid for nearly a week, in ammonium hydroxide for more than a month, and exposed to salt spray for 1000 hours at 95 F. These and many more laboratory tests proved the quality of the product.

Today, customers are benefitting from these tests and others. Underground and on rooftops, in water works and by the sea, in soil, steam, and smoke—in the toughest spots you can think of—G-E

White is demonstrating its superior corrosion resistance in actual installations.

The reason for this remarkable performance is to be found in the smooth, ductile zinc coating on G-E White. It is the result of a special metallizing process of zinc-galvanizing. Metallizing bonds a controlled and non-flaking coating of pure zinc to the entire exterior surface of the conduit—threads and all. The inside is protected by a corrosion-resistant organic coating which produces a smooth, stable surface.

And there are many more advantages to G-E White—it bends easier, for example, saws easier, and threads easier than old-style conduit. So get the whole story: See your G-E Construction Materials distributor or write Section C64-1218, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.



SULPHURIC ACID test typifies variety of lab tests which indicate G-E White's superior corrosion resistance to atmospheric conditions usually encountered in industrial areas.

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Representatives in major cities

A meeting of the 1957 Convention Committee was held November 16 in Buffalo prior to the Niagara Chapter's evening meeting at the Hotel Statler. The 1957 Convention is scheduled for May 12-16. Brig.-Gen. Henry Zipp Lang of Lang Electric Co., Buffalo, is general chairman.

New York Metropolitan Chapter met September 20 at Gondolier Restaurant. Guest speaker was Walter F. Hugger of Electro Technical Products Co. whose topic was salesmanship. Hosey Electric of Lindenhurst, N. J. was welcomed as a new member.

A group hospital-surgical-medical plan was made available to NISA members on Sept. 1, supplementing the group life insurance which was instituted by the Association last year. Joseph Dudley, NISA director from Flint, Mich., is chairman of the insurance committee.

On October 15 Great Lakes Chapter heard Robert B. Reed of Reliance Co. of Cleveland, Ohio, discuss adjustable speed drives. The meeting was held at Spaulding Electric Co., Detroit. Buffet dinner was served before the meeting.

Ed Grant was presented with a NISA past-president's plaque at a recent meeting of the Mid-South Chapter in Memphis. Grant, who served as national president in 1950-51, is president of Tennessee Electric Motor Service, Nashville, Tenn.

A similar presentation was made by NISA's Central District (Chicago) Chapter to Carl A. Sievert of Sievert Electric Co., Chicago. He was national president in 1940-41 and was a charter member of the Central District Chapter (1923), many years before the national organization was formed.

Bruce Tomlin of the U. S. Bureau of Apprenticeship was the guest speaker at the Mid-South Chapter meeting in Memphis September 15. The group were guests of Insulation & Wires, Inc. on a barbecue on a Mississippi River sandbar to which the chapter traveled aboard the Memphis Queen.

Northwest Central Ohio Chapter of NISA met in Springfield on October 27. A guest was NISA Executive Secretary Fred B. Wipperman. The group's next meeting will be held January 19 at Marion, Ohio.

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Ever try to hold a bunch of wires and clamp them securely at the same time? Let Clip-It do the work — This punched spring steel clip holds securely to the bolt on the electric wiring clamp while you tighten. Available in all sizes to fit clamp attachment bolts. Write for samples and quantity prices.

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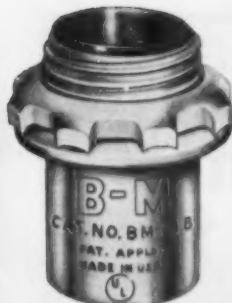
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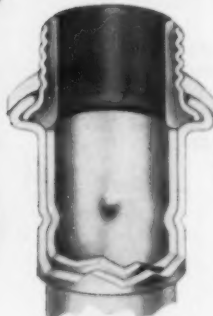
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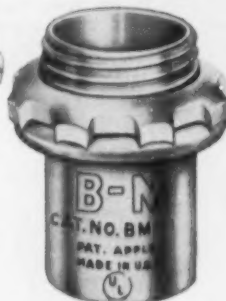
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Cutter for 1/2, 3/4
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SIZES FROM
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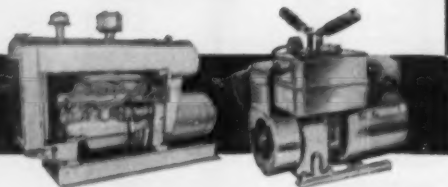
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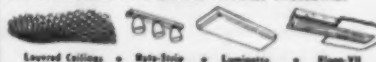
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DATES AHEAD

American Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, N. Y., January 21, 25, 1957; Summer General Meeting—Montreal, Que. (Canada), June 24-28; Pacific General Meeting—Yakima, Wash., August 28-30; Fall General Meeting—Chicago, Ill., October 7-11.

Plant Maintenance & Engineering Show and Conference—Public Auditorium, Cleveland, Ohio, January 28-31.

National Electrical Week—An all-industry event, February 10-16.

National Adequate Wiring Bureau Conference—13th annual conference, Sherman Hotel, Chicago, Ill., February 21-22.

National Electric Sign Assn.—Annual convention and exhibit, Sheraton Park Hotel, Washington, D. C., February 24-28.

American Society of Heating and Air Conditioning Engineers—Annual meeting, Chicago, Ill., February 25-28.

13th Interational Heating and Air Conditioning Exposition—Chicago, Ill., February 25-March 1.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 11-14.

Illuminating Engineering Society—Regional Conferences: Pacific Northwest—Empress Hotel, Victoria, B. C., March 28-29; South Pacific Coast—Statler Hotel, Los Angeles, Calif., April 3-5; Inter-Mountain—Hilton Hotel, Albuquerque, N. M., April 11-12; Southwestern—Holiday Inn, Oklahoma City, Okla., April 28-30; Midwestern—Astor Hotel, Milwaukee, Wisc., May 9-10; Great Lakes—Pantlind Hotel, Grand Rapids, Mich., May 13-14; Canadian—Sheraton Brock Hotel, Niagara Falls, Ont., May 16-17; East Central—William Penn Hotel, Pittsburgh, Pa., May 23-24; Northeastern—Hotel Statler, New York, N. Y., June 12-13.

Edison Electric Institute—23rd Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., April 1-4.

Fourth National Electrical Industries Show—Sponsored by Eastern Electrical Wholesalers Assn., 71st Regiment Armory, New York City, April 8-11.

National Association of Lighting Maintenance Contractors—Fourth Annual Meeting, Hotel Muelebach, Kansas City, Mo., April 29-May 1.

Air Conditioning and Refrigeration Institute—Annual meeting, The Homestead, Hot Springs, Va., May 6-8.

Chicago Electrical Industry Show—Conrad Hilton Hotel, Chicago, Ill., June 4-6.

New York State Association of Electrical Contractors and Dealers, Inc.—Annual convention, Saranac Inn, Saranac Inn, N. Y., July 2-5.

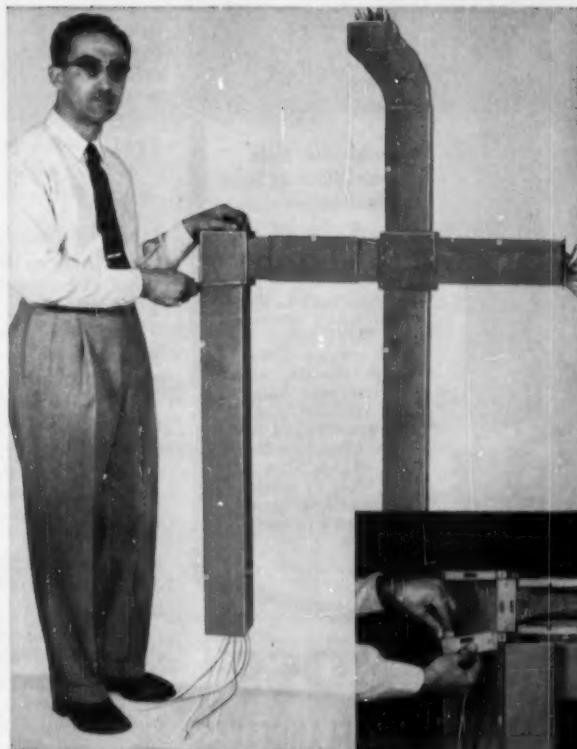
Illuminating Engineering Society—51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

National Electrical Contractors Association—Convention and Exposition, Netherland Plaza and Sheraton Plaza Hotels, Cincinnati, Ohio, November 11-16.

Make turns, angles, bends, tap-offs with General Electric's New 11-part, hinged cover, lay-in Wireway



1. Lay in wiring and use only 11 different parts. With only 11 different parts (half the number usually required), you can make the bends, angles, joints and tap-offs called for in complex electrical layouts—**because every fitting can do at least four different jobs.** And yet, every part, every fitting, no matter what the direction, opens up for **complete** lay-in wiring, including the telescopic length.



2. Hinged cover and hook-and-slot fittings cut assembly costs. Simple two-piece connectors are snapped into place (see inset above), fitting cover plates are screwed on and full-length covers of straight sections are swung and snapped closed—to complete in less time than ever before possible the estimating, ordering, and installation of a complete wireway system.



3. Each fitting does at least 4 jobs. Every fitting goes right, left, up and down, cutting the number of "special" fittings needed. When the end plate is removed from the 90° elbow (shown at left joined to straight section), it can also be used as 4-direction tee fitting—a total of 8 fittings in 1!

The simple, flexible design of the new Type HW Wireway has made possible a new, low price. Three sizes are stocked—4 by 4 inches, 6 by 6 inches and 8 by 8 inches. For more data, see your G-E Distributor or Sales Representative. Or write for Bulletin GEC-1426 to General Electric Company, Distribution Assemblies Dept., Plainville, Conn.

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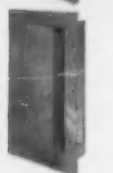
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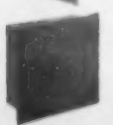
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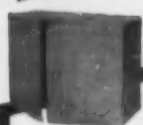
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BOSS Wireway and Fittings are easily adapted for "close fit" jobs where space is at a premium. Available in a wide range of sizes. Flangeless wireway is equipped with screw shields to protect wire as it is drawn through. Elbows, tees, closing plates. Telescoping fittings, nipples, hangers . . . these and other fittings are available in flanged wireway.

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Among the Manufacturers

Headquarters Announcements

Halo Lighting Products Co. has been formed to manufacture recessed incandescent lighting units. Offices and plant are located at 2104 N. Orchard St., Chicago, Ill. Principals in the new firm are Fred Gordon and Robert Fremont. Jasper Blackburn Corp., St. Louis, Mo.—Ray N. Leach, president.

Kellogg Switchboard & Supply Co., Chicago, Ill.—Carl F. Megelin, sales manager for the Commercial Products Dept.

Anderson Electric Corp., Birmingham, Ala.—Kenneth A. Fleck, engineering manager.

Sylvania Electric Products Inc., Salem, Mass.—R. G. Slauer, head of new sales group for fluorescent lighting fixtures. C. J. Corothers, Jr. will handle national sales of mercury vapor lamps.

Tork Time Controls Inc. is the new name of the Tork Clock Co. of Mt. Vernon, N. Y. J. H. Beier has been appointed chief engineer.

General Electric Co., Plainville, Conn.—W. W. Smith, manager—Service Entrance Equipment Sales for the Circuit Protective Devices Dept.

G & W Electric Specialty Co. has relocated its offices and plant to 3500 W. 127th St., Blue Island, Ill.

Electrical Fittings Corp., Woodside, N. Y.—Dick Noel, national sales manager.

Westinghouse Electric Corp., Bloomfield, N. J.—Robert D. Barr, general sales manager of the Large Lamp Dept.

Everwarm, Inc. has relocated its Knoxville, Tenn. headquarters to a new building on Pleasant Ridge Rd.

Westinghouse Electric Corp., Pittsburgh, Pa.—H. B. West, assistant manager of the Transformer Division. R. N. McCollom is manager of the new Power Transformer Dept. of the division and J. C. Rissinger is sales manager of that department.

Regional Appointments

NEW ENGLAND

Westinghouse Electric Corp.: Edward C. Delano, assistant to the vice president for the northeastern region. Paul B. Shiring, manager of the Boston district.

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Cost...
it Pays
to use...

HELWIG CARBON BRUSHES

Brushes are manufactured to size — need not be cut down to fit commutator. It pays to protect your electrical equipment with HELWIG CARBON BRUSHES.

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Never fail in any emergency because they operate without current of any kind over a distance of many miles. Can be moved with the job as construction progresses or serve permanently where power failures may occur. In outdoor and indoor models.



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O.Z. pull boxes

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TIME!**

**SAVE
SPACE!**

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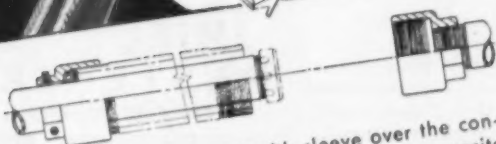
ASSEMBLED
PULL BOX

The easiest, most economical way to speed installation of conduit—of any size from $\frac{1}{2}$ " to 6"—is to use O. Z. Pull Boxes. Two hot dip galvanized malleable iron units fitted to an oversize length of pipe replace the conventional, bulky and costly pull box . . . cuts labor time in half!

O. Z. Pull Boxes are available in four designs: standard (Type "PB"); weather-tight (Type "PBW"); explosion proof and thin wall conduit. The oversize sleeve can be cut to required length "on the job" from standard conduit, or furnished to your specifications by O. Z.

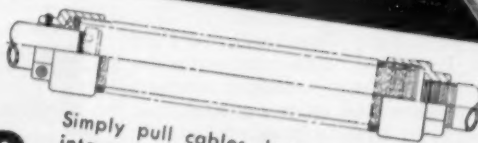
Call your local O. Z. distributor, or write direct to the company for complete information.

JUST
TWO
SIMPLE
ASSEMBLY
STEPS



1. Slide head "A" with sleeve over the conduit end. Attach head "B" on opposite conduit.

TYPE "PBW"



2. Simply pull cables, loop and feed back into oversize sleeve. Slide head "A" with head "B". Tighten set screws to lock "A"

OVERSIZE SLEEVE

SLIDING HEAD "A"

SET SCREWS

CONDUIT



O.Z.

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CLEVELAND 12, OHIO

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Please send complete details
about your service immediately
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Name
Company
Address
City..... Zone.... State....

Joy Manufacturing Co.: John E. Moody, district manager of the Boston Industrial district sales office.

Sylvania Electric Products Inc.: C. J. Kelleher, northeast area sales manager for fixtures.

Line Material Co.: Archie Bowser, branch supervisor and C. L. Hopkins, field engineer at new sales office and warehouse at 54 Pane Rd., Newington, Conn.

Westinghouse Electric Corp.: Louis L. Nealon, Belmont district sales manager for the Lamp Division. The district comprises Maine, Vermont, New Hampshire and eastern Massachusetts.

MIDDLE ATLANTIC

Allis-Chalmers Mfg. Co.: G. E. Conn, manager of Buffalo, N. Y. district; MacGregor G. Jones will hold the same position at the York, Pa. district office; and O. V. Tally becomes manager at the Washington, D. C. office.

Pass & Seymour, Inc.: William E. Carroll, sales representative for the Pittsburgh, Pa. territory.

Joy Mfg. Co.: Don L. Archibald, manager of the newly formed New York Industrial District sales office.

Westinghouse Electric Corp.: William G. Cheney, area sales manager of the New York City district.

SOUTH ATLANTIC

John A. Roebing's Sons Corp.: John H. Bass, Jr., representative for the Construction Materials Division in the southeast; offices in Atlanta, Ga.

Sylvania Electric Products Inc.: Paul P. Harrison, fixture sales manager for the southeast area with headquarters in Atlanta, Ga.

EAST CENTRAL

Tork Time Controls Inc.: Fred C. Baldrige, sales representative for Mississippi, Louisiana, western Tennessee and southern Alabama; offices in New Orleans.

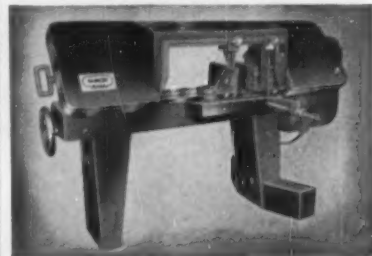
BullDog Electric Products Co.: John G. Freihaut, field engineer at the Louisville, Ky. office.

Miller Co.: Don W. Houser, sales representative for the Columbus-Central Ohio territory.

General Electric Co.: The Construction Materials Division has opened a new warehouse and sales office at 4520 W. 160th St., Cleveland, Ohio.

Sylvania Electric Products Inc.: Robert L. Kuschwa, central area manager of fixture sales; offices in Chicago, Ill.

KALAMAZOO METAL CUTTING BAND SAW



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Globe Lighting Products, Inc.: Donald Jacobsen, sales representative for northern east central states with headquarters in Cincinnati, Ohio.

WEST CENTRAL

J. R. Richards Co.: Elmer E. Scheetz, Jr., representative for eastern Missouri and southern Illinois, working out of St. Louis.

General Electric Co.: Michael C. Finn, manager of Large Lamp Dept. sales for the Northern District with headquarters in Minneapolis, Minn.

Line Material Co.: Charles L. Snail, field engineer for northeastern Kansas and northwestern Missouri. Offices in Topeka, Kansas.

Allis-Chalmers Mfg. Co.: Charles F. O'Riordan, manager of the Midwest region for the Industries Group with headquarters in St. Louis.

Sylvania Electric Products Inc.: John G. Felton, manager of fixture sales in the southwest area; offices in Dallas, Texas. Marvin Schylling, St. Louis district sales manager for the Lighting Division.

Globe Lighting Products, Inc.: H. Wexler, representative in Minneapolis-St. Paul area.

WEST

NuTone, Inc.: New warehouse and sales offices have been opened at 237 W. 30th St., Los Angeles, Calif.

Peerless Electric Co.: Karl Sweikardt, factory sales representative for the Fan & Blower Division in the New Mexico area. Offices in Albuquerque.

Union Malleable Mfg. Co.: David A. Kates, vice president in charge of the Western Division. Headquarters in Los Angeles.

Sylvania Electric Products, Inc.: W. L. Friend, Pacific Coast regional sales manager for the Lighting Division. Carl S. Long, Jr., lighting sales manager of the newly-established Rocky Mountain district. Offices in Denver, Colorado. T. J. Holland, district sales manager for lighting in the Seattle, Washington area. Garland R. Barlogi, district sales supervisor-lighting in Portland, Oregon. J. Clayton Stephens, district sales manager-lighting at Los Angeles with C. H. Connely as assistant. Roger J. Delander, manager of fixture sales in the western area; offices in San Francisco, California.

Lightolier, Inc.: Nat Blumberg, vice president in charge of West Coast operations. Headquarters in Los Angeles.

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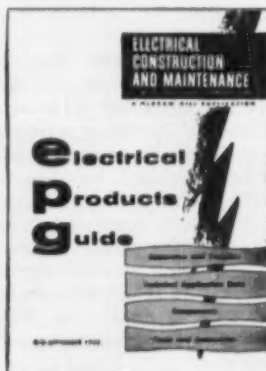
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For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE... the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

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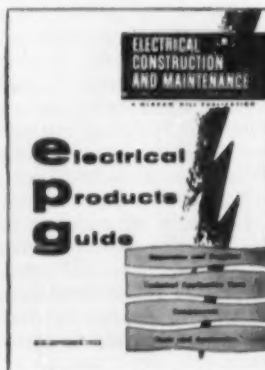
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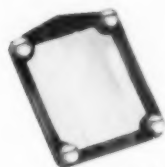
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DESIGNED TO DO
HUNDREDS OF JOBS... **Better!**



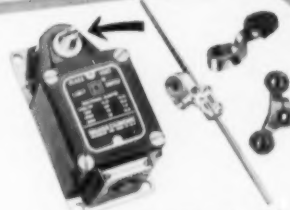
HEAVY DUTY
OIL-TIGHT • Class 9007, Type T



Instant visual inspection of mechanism through transparent plastic cover (optional). A tremendous timesaver in multiple switch installations.



Eleven contact arrangements in one switch...and all you need to make the changes is a screwdriver!



Simplified stocking because basic switches and a wide variety of lever arms are packaged separately. Moderate stock handles a multitude of combinations.



Continuously adjustable operating lever arms permit an infinite number of adjustments. Up to 80° overtravel reduces arm breakage.

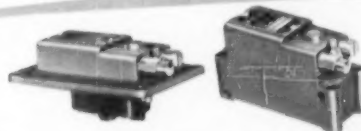


Easy mounting and interchangeability through wide variety of base plates and side mounting holes.



**SMALL
OIL-TIGHT**
Class 9007, Type A

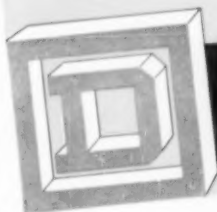
Roller arms are available in a wide range of designs and lengths.



Small precision limit switch available in three forms—basic contact mechanism, flush or surface mounting. Both flush and surface mounting switches are available with varying lengths of roller arms and with rollers of different types and sizes. Also push rod operated (shown above) and in single unit or duplex construction.

Write
for Bulletin 9007
which gives the
complete details
of Square D's
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of oil-tight
limit switches
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Wisconsin

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!



SQUARE D COMPANY



Dry-Type Transformer

NEWS



A point of interest: "The Mountaineer" can uncover a seam of coal lying beneath a 90-foot overburden of soil and rock.

General Electric dry-type transformers help maneuver over two thousand tons of mechanical brawn

This is "The Mountaineer," giant power shovel built by the Marion Power Shovel Company for the Hanna Coal Company, Division of Pittsburgh Consolidation Coal Company. To assure fast, dependable maneuverability of the over two-thousand-ton shovel, engineers

teamed General Electric control, and voltage-stabilizing transformers. Result: by providing stabilized output to control circuits, the G-E transformers help make it possible for "The Mountaineer" to lift 90 tons, deposit the tonnage 290 feet away, and return for another load in 45 seconds.

Alkanex wire trims down size, weight of G-E dry-type transformers



Here's another General Electric "first" in the development of quality dry-type transformers. New, heat-resistant aluminum Alkanex wire is being used to make General Electric dry-type transformers lighter, easier to handle. Weight and size reduction of the transformers results in at least three immediate benefits: reduced shipping costs, easy portability during plant relocation, and space-saving installation in out-of-the-way wall or ceiling areas.

General Electric dry-type transformers and saturable reactors pay for themselves in three months

By substantially increasing the productive capacity of a "booster-melting" glass furnace, the General Electric transformers and saturable reactors paid for themselves in 90 working days. The G-E equipment provides an extra boost of electric heat, decreasing viscosity of the molten glass, and thus making the glass easier to pour, easier to mold. For further information write General Electric Company, Section 410-25, Schenectady 5, New York.

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